



Title: Biogas Production, through low-cost tubular system for energy in the Tlalmanalco municipality

Authors: LOZANO-CAMARGO, Maria Luisa, GALICIA-LUIS, Laura and FIGUEROA-DELGADO, Pablo Jesús

Editorial label ECORFAN: 607-8695

BCIERMMI Control Number: 2021-01

BCIERMMI Classification (2021): 271021-0001

Pages: 16

RNA: 03-2010-032610115700-14

ECORFAN-México, S.C.

143 – 50 Itzopan Street

La Florida, Ecatepec Municipality

Mexico State, 55120 Zipcode

Phone: +52 1 55 6159 2296

Skype: ecorfan-mexico.s.c.

E-mail: contacto@ecorfan.org

Facebook: ECORFAN-México S. C.

Twitter: @EcorfanC

www.ecorfan.org

Holdings

Mexico	Colombia	Guatemala
Bolivia	Cameroon	Democratic
Spain	El Salvador	Republic
Ecuador	Taiwan	of Congo
Peru	Paraguay	Nicaragua

Introduction

There are several models of biodigesters, some have more advanced technological features, but this research proposes the use of low-cost tubular biodigesters as implementation, to the various problems and theoretical solutions, which are suitable to the social, economic and environmental context of the municipality of Tlalmanalco through minimal investment in materials, installation and maintenance, which is focused on sustainability, promoting long-term benefits throughout the community, especially in areas most lacking in economic resources and services, to directly influence sustainable development.

Objetives

General Objectives

Analyze the characteristics and energy benefits of low-cost tubular systems, for their future implementation in economically vulnerable areas in the municipality of Tlalmanalco.

Specific objectives

Determine the sustainable potential of Tlalmanalco, to analyze the projection feasibility of biogas generating systems.

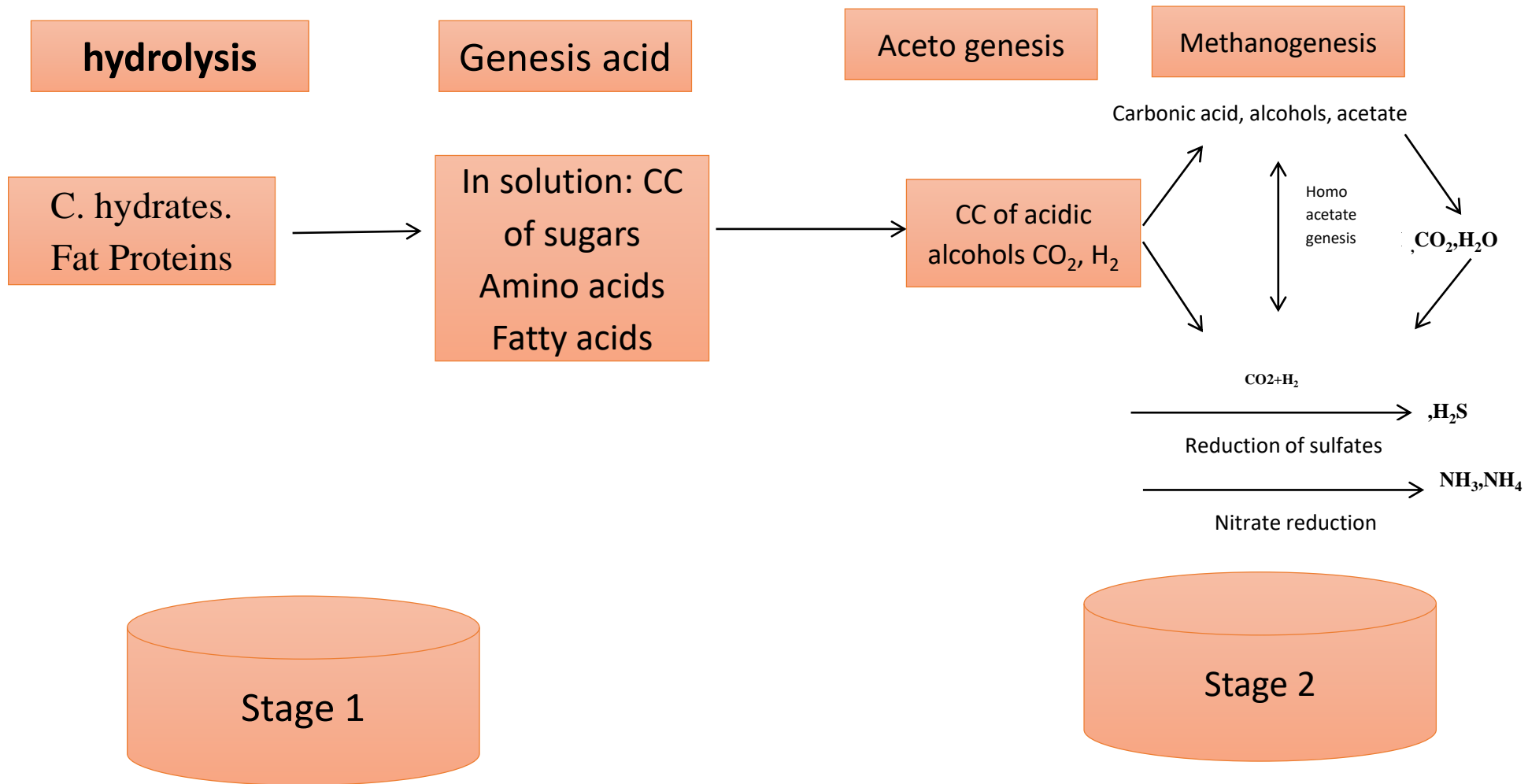
Energy benefits of tubular systems in the population of the municipality of Tlalmanalco

Methodology

Several scientific articles on biogas generation focused on low-cost tubular systems were analyzed in order to extract relevant information, with the purpose of making known some characteristics about the sustainable energy potential of these systems in order to promote their implementation, acceptance and benefits in the society of Tlalmanalco.

Development

Anaerobic digestion



Biogas

It is a gas that is produced in natural conditions, as in places suitable for man, where biodegradation reactions of organic matter originate, by the action of microorganisms (methanogenic bacteria), in anaerobic conditions

Table 1. Biogas composition

Composition	55 - 70% methane (CH ₄) 30 - 45% carbon dioxide (CO ₂) Traces of other gases
Energetic content	6.0 - 6.5 kW h m ³
Fuel equivalent	0.60 - 0.65 L oil / m ³ biogas
Explosion limit	6 - 12% biogas in the air
Ignition temperature	650 - 750 ° C (with CH ₄ content mentioned)
Critical pressure	74 - 88 atm
Critical temperature	-82.5 ° C
Norm density	1.2 kg m ⁻³
Smell	Rotten egg (the smell of desulfurized biogas is imperceptible)
Molar mass	16,043 kg kmol ⁻¹

Source of consultation: Varnero, 2011

Biodigesters

They are sealed containers, which have the purpose of generating methane-rich gas (Avila, 2016).

Table 2 . MOST CONVENTIONAL BIODIGESTERS

Biodigester	Characteristics	Advantage	Disadvantages
Floating dome (Hindu)	It is buried vertically in what appears to be a well, its structure has resistant materials such as brick or concrete. This digester has a floating hood that regulates the gas pressure and that rises and falls depending on the volume exerted.	Simple systems to understand. Constant gas pressure.	High construction and maintenance costs.
Fixed dome (china)	They are generally cylindrical containers, which are constructed of resistant materials such as concrete, cement or concrete.	Long lasting time. Withstands drastic weather changes.	Fragmentation of the material due to high internal pressures. For its construction it requires skilled labor.
Tubular Biodigester (Taiwanese)	Regularly, the material used for its construction is polyethylene (PE), or geomembrane (PVC), it has a horizontal tubular shape and is half buried in a trench, in order to adapt the biodigester in a fixed and safe position.	Accesible price. It is portable and can be easily placed in any difficult access place	Short life time. Breakages due to drastic weather changes (solar tent must be used)

Tlalmanalco municipal context

Tlalmanalco de Velázquez is a municipality located in the eastern part of the State of Mexico.

Table 3 . General Aspects of the Tlalmanalco

Important aspects (SAE) of Tlalmanalco	General data
Coordinates	19° 80 '48 ''and 19° 15' 43'' of north latitude and 98° 37 '58 ''and 98° 51' 20'' of west longitude
Total population (2021)	47,390 inhabitants
Area Km2	158.58 km
HDI (2015)	0.779%
Poverty (2015)	22,833 inhabitants
Altitude	2400m
GDP (2017)	1253.4
Climate	Temperate coniferous forest
Rural population (2010)	7,746 inhabitants

Social pillar: Is in charge of analyzing the social and economic conditions required by the families of Tlalmanalco

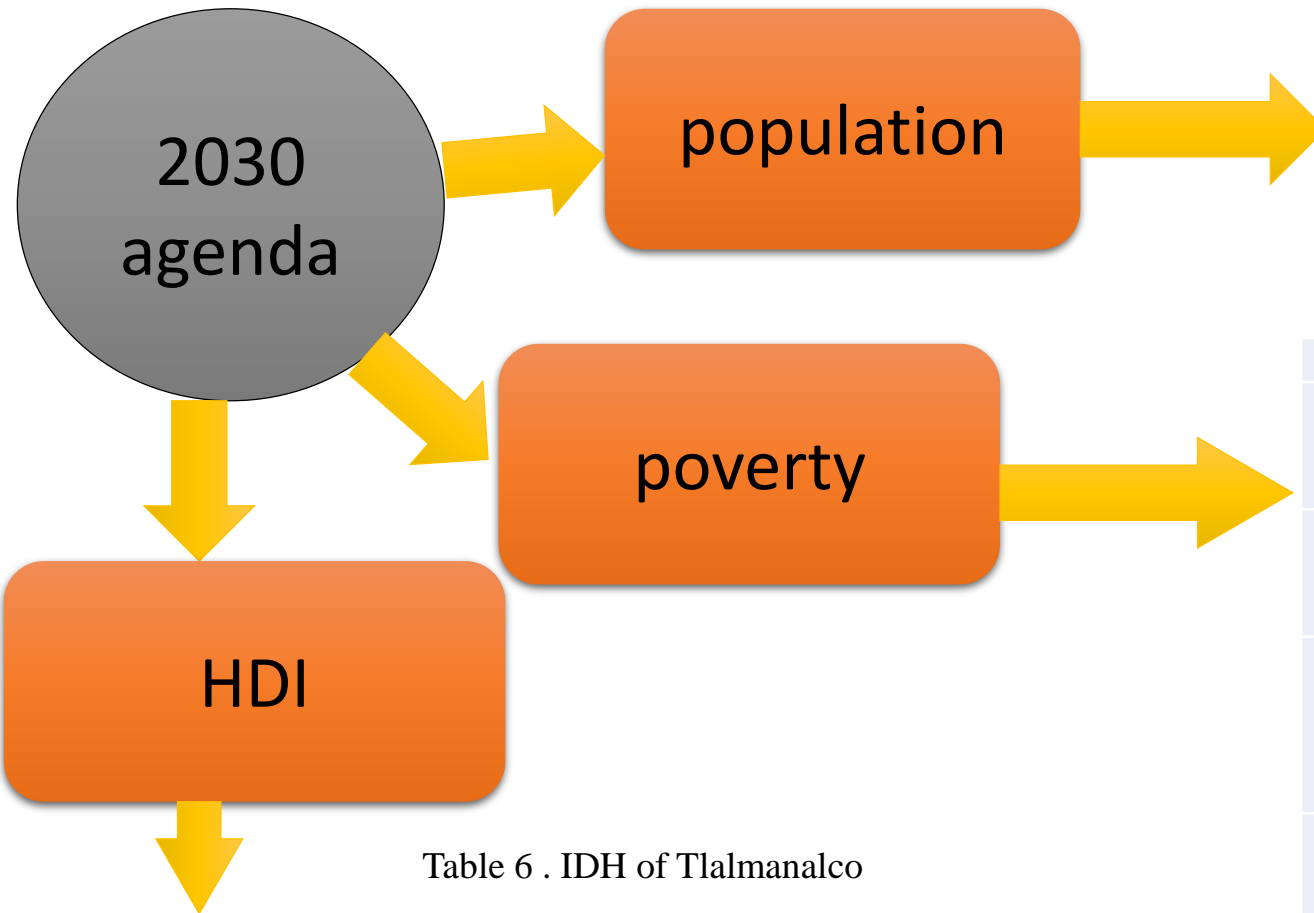


Table 4 . Population and housing census 2010 and 2015

Year	2010	%	2015.	%
Men	22,333	51.78%	22,517	47.51%
women	23,797	51.58%	24,873	52.48%
Total	46,130	100%	47,390	100%

Consulted source: Planning Unit of the Municipality of Tlalmanalco, 2019

Table 5 . Tlalmanalco poverty report

Indicators	YEAR 2012			YEAR 2015		
	Population	%	Average deficiency	Population	%	Average deficiency
Poor population	17,903	41.7	2.4	22,833	45.6	2.0
Population with moderate poverty	15,484	34.5	2.1	19,897	39.7	1.8
Population with extreme poverty	2,420	6.9	3.7	2,936	5.9	3.4

Reference source: Planning Unit of the Municipality of Tlalmanalco. (2019)

Table 6 . IDH of Tlalmanalco

	Health	Education	Entry	HDI
Tlalmanalco	0.786	0.735	0.698	0.739

Source consulted: Planning Unit of the Municipality of Tlalmanalco, 2019)

Economic pillar: In the municipality of Tlalmanalco, management systems that favor wealth, social values and respect for the environment must be adapted to obtain sustainable development

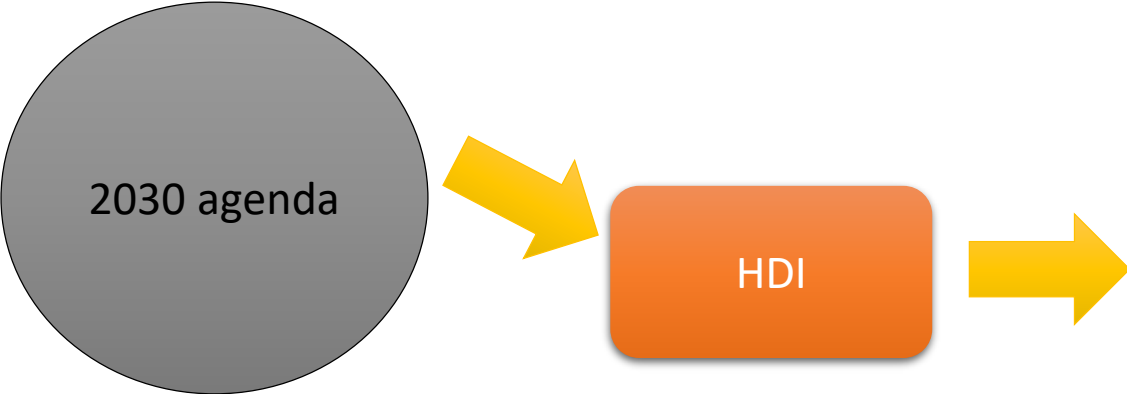
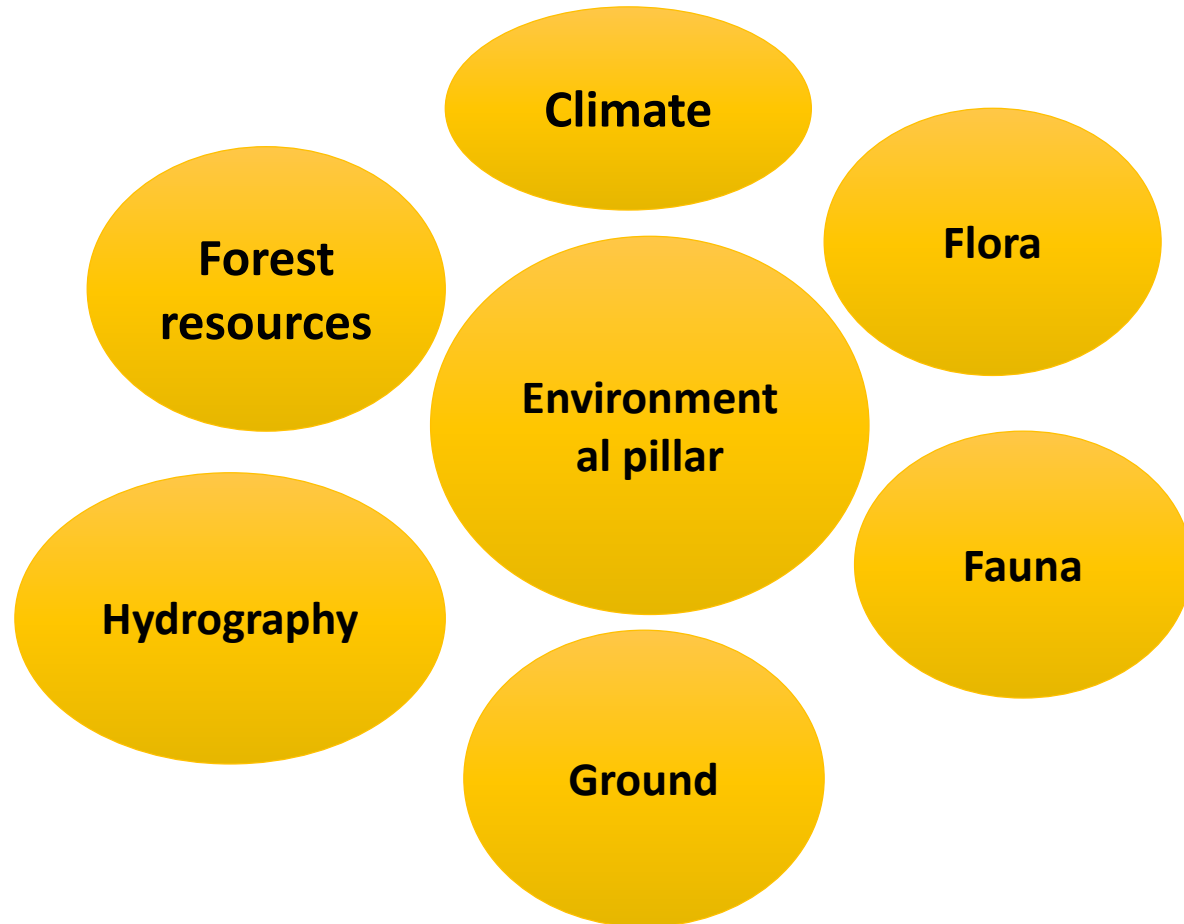


Table 7 . GDP of Tlalmanalco

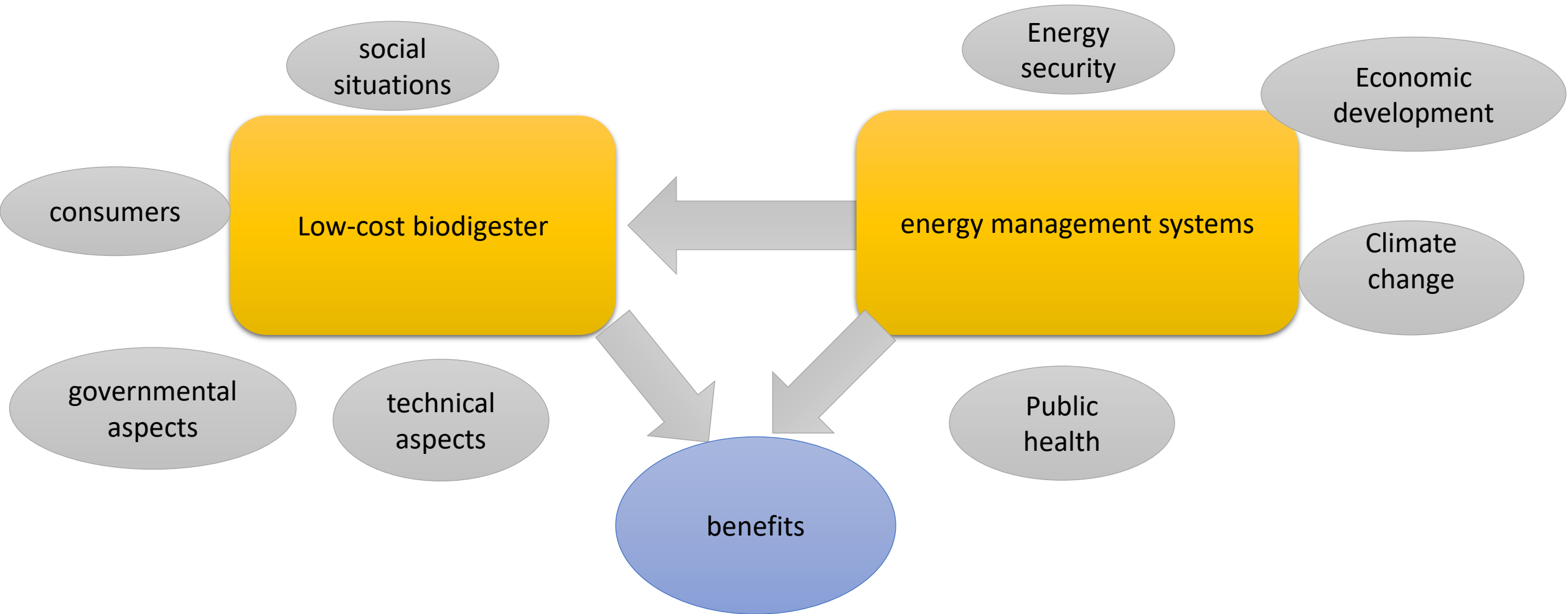
GDP of Tlalmanalco		
Economic activity sector	2016	2017
Agriculture, animal husbandry and export, forestry, fishing and home	37.8	48.3
Industry	630.3	637.9
Mining	0.9	1.8
Generation and transmission of electrical energy	35.1	34.4
Manufacturing industry	586.8	595.3
Services	346.5	511.3
Shops	99.5	148.0
Educational services	23.3	34.4
Health and social assistance services	4.8	8.9

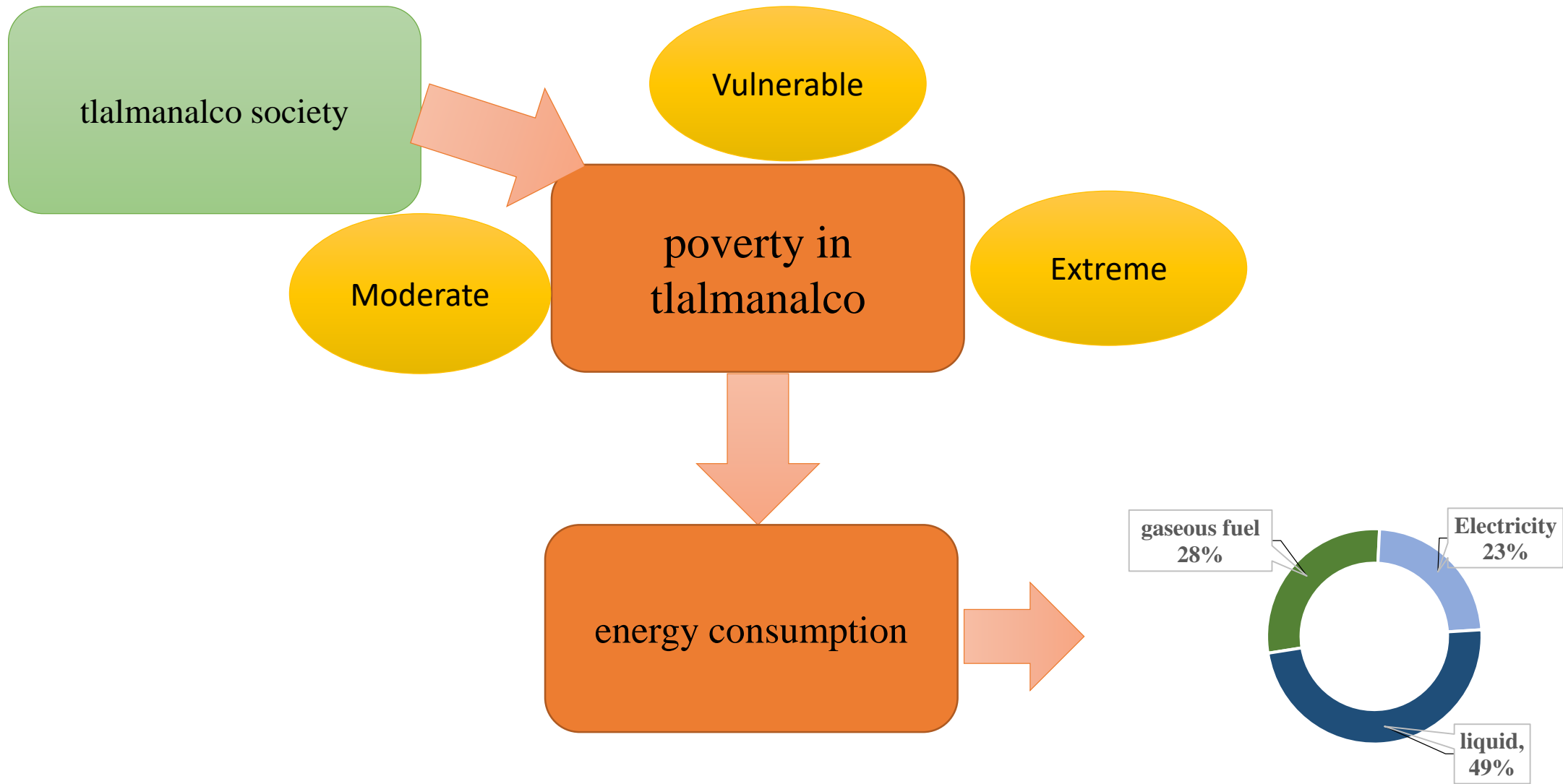
Consulted source: Planning Unit of the Municipality of Tlalmanalco. (2019)

Environmental pillar: Seeks the care of the environment and the proper use of natural resources, it is essential to supply economic and social needs in a conscious way. Renewable energies are essential to plan a present and a future, which avoids the depletion of non-renewable resources.



Low-cost biodigester in Tlalmanalco





Reference source: *Global Covenant of mayors for Climate & Energy. (2019)*

Results

Table 8 . Results

Energy generation	Production	Family health	Animal hygiene	Environment	Workload and economy	Sustainable technology	Low cost
Generates biofuel	biol	controls gases CH ₄ and CO ₂	controlled and diseases	reducing the use of fossil fuels	use of fecal waste instead of firewood or fuels	avoids inappropriate use of natural resources	150 and 200 US dollars

Consulted source: Marti,2021

Conclusions

The theoretical study carried out on the municipality of Tlalmanalco, in terms of geographical area, as well as the most vulnerable areas, the services it has and the energy expenditure it has per inhabitant per year; allows observing that even when there are no statistical data from INEGI, IGECM for recent years, this municipality has the characteristics and adequate spaces to implement a low-cost tubular biodigester system, greatly favoring the economic energy costs of the community, at the same time.

Acknowledgment

To the Tecnológico de Estudios Superiores del Oriente del Estado de México
for providing all the facilities to carry out this research.

Autonomous Metropolitan University-Iztapalapa, Department of Chemistry

CIERMMI, Woman in science

Reference

Avila, C. (2016). USO DE BIODIGESTORES EN LA INDUSTRIA PECUARIA. 17/07/2021, de UNIVERSIDAD AUTÓNOMA DEL ESTADO DE MÉXICO Sitio web: <http://ri.uaemex.mx/bitstream/handle/20.500.11799/66337/TESINA-CAV-1016.pdf?sequence=1>

Global Covenant of mayors for Climate & Energy. Data Portal for Cities. 2019. Disponible en línea en: <http://www.dataportalforcities.org>

Pérez, J, A. (2010). ESTUDIO Y DISEÑO DE UN BIODIGESTOR PARA APLICACION EN PEQUEÑOS GANADEROS Y LECHEROS. 10/03/2021, de UNIVERSIDAD DE CHILE Sitio web: http://repositorio.uchile.cl/bitstream/handle/2250/103926/cf-perez_jm.pdf?sequence=3

Unidad de Planeación del Municipio de Tlalmanalco. (2019). PLAN DE DESARROLLO MUNICIPAL 2019-2021. 10/03/2021, de Gobierno Municipal de Tlalmanalco Sitio web: https://www.tlalmanalco.gob.mx/pdf_gacetas/68.pdf

Varnero, M, T. (2011). MANUAL DE BIOGÁS. 10/03/2021, de Gobierno de Chile Ministerio de Energía Sitio web: <http://www.fao.org/3/as400s/as400s.pdf>



ECORFAN®

© ECORFAN-Mexico, S.C.

No part of this document covered by the Federal Copyright Law may be reproduced, transmitted or used in any form or medium, whether graphic, electronic or mechanical, including but not limited to the following: Citations in articles and comments Bibliographical, compilation of radio or electronic journalistic data. For the effects of articles 13, 162,163 fraction I, 164 fraction I, 168, 169,209 fraction III and other relative of the Federal Law of Copyright. Violations: Be forced to prosecute under Mexican copyright law. The use of general descriptive names, registered names, trademarks, in this publication do not imply, uniformly in the absence of a specific statement, that such names are exempt from the relevant protector in laws and regulations of Mexico and therefore free for General use of the international scientific community. BCIERMMI is part of the media of ECORFAN-Mexico, S.C., E: 94-443.F: 008- (www.ecorfan.org/booklets)