An ERA-NET financed by FP7

ERANET-LAC
JOINT CALL 2015-2016

Full Proposal Form

Project acronym:	**Bowso**
Project Coordinator:	**Dr. William Camilo** Universidad APEC, República Dominicana
Ref.:	**ELAC2015/T03-0790**

Funded by the following EU CELAC R&I funding agencies:

EU Member States and Associated Countries:

- Belgium: Belgian Science Policy, BELSPO
- Belgium: Fund for Scientific Research, F.R.S-FNRS
- Finland: Academy of Finland, AKA
- France: Institut of Research for Development, IRD
- Germany: AiF Project GmbH | Project management agency of BMWi, AiF
- Germany: Federal Ministry of Education and Research, BMBF
- Italy: Ministry of Health, SANITA
- Italy: National Research Council, CNR
- Latvia: State Education Development Agency, VIAA
- Norway: The Research Council of Norway, RCN
- Poland: National Centre for Research and Development, NCBR
- Portugal: Foundation for Science and Technology, FCT
- Romania: Executive Agency for Higher Education, Research, Development and Innovation Funding, UEFISCDI
- Spain: Institute of Health Carlos III, ISCIII
- Spain: Ministry of Economy and Competitiveness, MINECO
- Turkey: The Scientific and Technological Reseach Countil of Turkey, TUBITAK

Latin American and Caribbean Countries:

- Argentina: Ministry for Science, Technology and Productive Innovation, MINCyT
- Barbados: Caribbean Science Foundation, CSF
- Bolivia: Ministry of Education - Vice Ministry of Science and Technology, MINEDU
- Brazil: National Council for Scientific and Technological Development, CNPq
- Brazil: Research Support Foundation of the State of Rio de Janeiro, FAPERJ
- Brazil: Research Support Foundation of the State of Sao Paulo, FAPESP
- Chile: National Council for Science and Technological Research, CONICYT
- Colombia: Administrative Department of Science, Technology and Innovation, COLCIENCIAS
- Dominican Republic: Ministry of Higher Education, Science and Technology, MESCyT
- Ecuador: Secretariat of Higher Education, Science, Technology and Innovation, SENESCYT
- Guatemala: National Council of Science and Technology, CONCYT
- Mexico: National Council for Science and Technology, CONACYT
- Panama: National Secretary of Science, Technology and Innovation, SENACYT
- Peru: National Council of Science, Technology and Innovation, CONCYTEC
- Trinidad & Tobago: National Institute of Higher Education, Research, Science and Technology, NIHERST
- Uruguay: National Research and Innovation Agency of Uruguay, ANII

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INFORMATION RELATING TO THE COMPOSITION OF THE PROJECT CONSORTIUM

Project acronym:	Bowso		
Project full title:	Biorefineries for organic waste in slaughterhouses		
Topics:	Topic #03: Biorefinery - Fractionation and valorisation of residual biomass to intermediate and/or final high added value bioproducts		
Keywords:	Biological production, conservation and utilisation of energy Biological research and technology		
Total project costs:	1.048.308,00 €	Total requested funding:	700.795,00 €
Project duration (months):	36	Expected start date (mm/yyyy):	03/2017
Total Effort (Person Months):	226,44 PM		

1. Project Coordinator Details

First Name:	William	Title:	Dr.
Family Name:	Camilo	e-mail:	wcamilo@unapec.edu.do
Position held:	Project Team Leader	Telephone:	(8498) 577011
Organisation Name:	Universidad APEC	Organisation website:	http://www.unapec.edu.do
Address of the organisation:	Av. Máximo Gómez 72 809 Santo Domingo	Country:	República Dominicana

2. Consortium: Details of the Organizations involved

Organisation	Contact Person / e-mail	Activity type[1]	Applying for funding from
Universidad APEC *	Dr. William Camilo wcamilo@unapec.edu.do	HE	Ministry of Higher Education, Science and Technology (MESCyT) (Dominican Republic)
Universidad Tecnológica de Panamá	Dr. Humberto Álvarez humberto.alvarez@utp.ac.pa	HE	National Secretary of Science, Technology and Innovation (SENACYT) (Panama)
ESPOL	PhD Emérita Delgado Plaza eadelgad@espol.edu.ec	HE	Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT) (Ecuador)
Istituto di Tecnologie Avanzate per l'Energia	Dr. Giuseppe Bonura giuseppe.bonura@itae.cnr.it	RES	National Research Council (CNR) (Italy)
Åbo Akademi University	Prof. Dmitry Murzin dmurzin@abo.fi	HE	Academy of Finland (AKA) (Finland)
Università di Padova, Italy	Dr. Andrea Marion andrea.marion@unipd.it	HE	National Research Council (CNR) (Italy)
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	M.Eng. Mayra Paucar Samaniego ma.paucar@uta.edu.ec	HE	Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT) (Ecuador)

[1] HE – Higher Education, RES – Research, IND – Industry, SME, OTH - Others

3.1. Overall Project Costs

Organisation	Person Months	Costs (€)	Partner Contribution (€)	Requested Funding (€)
Universidad APEC *	1,44	200.000,00 €	0,00 €	200.000,00 €
Universidad Tecnológica de Panamá	50,00	263.495,00 €	213.500,00 €	49.995,00 €
ESPOL	36,00	66.000,00 €	26.000,00 €	40.000,00 €
Istituto di Tecnologie Avanzate per l'Energia	19,00	133.333,00 €	33.333,00 €	100.000,00 €
Åbo Akademi University	40,00	260.480,00 €	74.680,00 €	185.800,00 €
Università di Padova, Italy	8,00	75.000,00 €	0,00 €	75.000,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	72,00	50.000,00 €	0,00 €	50.000,00 €
TOTAL	226,44	1.048.308,00 €	347.513,00 €	700.795,00 €

3.2. Detailed Project Costs

3.2a. Personnel Costs

Organisation	Average Monthly Salary (€)	Nº of Man-Months	Total Cost (€)	Requested Funding (€)
Universidad APEC *	1.041,00 €	4,00	140.000,00 €	140.000,00 €
Universidad Tecnológica de Panamá	1.000,00 €	50,00	50.000,00 €	0,00 €
ESPOL	100,00 €	2,00	10.000,00 €	2.000,00 €
Istituto di Tecnologie Avanzate per l'Energia	4.105,00 €	19,00	78.000,00 €	44.667,00 €
Åbo Akademi University	2.500,00 €	40,00	100.000,00 €	75.000,00 €
Università di Padova, Italy	8.358,00 €	8,00	69.000,00 €	69.000,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	416,00 €	72,00	30.000,00 €	30.000,00 €
SUBTOTAL	17.520,00 €	195,00	477.000,00 €	360.667,00 €

3.2b. Equipment

Organisation	Description	Total Cost (€)	Requested Funding (€)

Universidad APEC *	1) 2 kw, Hi temp. Fuel Cell 2) 30 m3 Anaerobic Biodigester 3) Auxiliary Equipment 4) Desinfectation UV unit 5) Security and measurements Devices 5) Control and powering appliances, etc.	40.000,00 €	40.000,00 €
Universidad Tecnológica de Panamá	Anaerobic Biodigester Prototype plant for 14,200 kg organic waste and biogas daily production of 680 m3	105.450,00 €	45.450,00 €
ESPOL	Medidor Temperature, PH, flux, and instrumental minor	8.000,00 €	5.000,00 €
Istituto di Tecnologie Avanzate per l'Energia	GC-MS: analysis of liquid solutions from SCWG	25.610,00 €	25.610,00 €
Åbo Akademi University	Not applicable	0,00 €	0,00 €
Università di Padova, Italy	N/A	0,00 €	0,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	Ultraviolet (UV) Device for effluens, and biogas meters	14.000,00 €	14.000,00 €
SUBTOTAL		193.060,00 €	130.060,00 €

3.2c. Materials

Organisation	Description	Total Cost (€)	Requested Funding (€)
Universidad APEC *	30 m3 Metalic Biodigester Estructure, and Sand & activated carbon filters	10.000,00 €	10.000,00 €
Universidad Tecnológica de Panamá	Biodigester estructure for 680 m3, Sand and activate carbon filters, control & power devices, etc.	85.000,00 €	0,00 €
ESPOL	Structural consumables and pipe	3.000,00 €	2.000,00 €
Istituto di Tecnologie Avanzate per l'Energia	Consumables for lab	11.000,00 €	11.000,00 €
Åbo Akademi University	Chemicals, gases	24.000,00 €	16.000,00 €
Università di Padova, Italy	N/A	0,00 €	0,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	N/A	0,00 €	0,00 €
SUBTOTAL		133.000,00 €	39.000,00 €

3.2d. Sub-Contracting

Organisation	Subcontractor	Description	Total Cost (€)	Requested Funding (€)
ESPOL	Tecnico	prototype pyrolyzer: construction and implementation	10.000,00 €	9.500,00 €

Organisation	Subcontractor	Description	Total Cost (€)	Requested Funding (€)
ESPOL	Técnico	prototype anaerobic digester: construction and implementation	10.000,00 €	8.500,00 €
ESPOL	Técnico	prototype gasifier: construction and implementation	10.000,00 €	8.000,00 €
SUBTOTAL			30.000,00 €	26.000,00 €

3.2e. Travel and Subsistence Costs

Organisation	Description	Total Cost (€)	Requested Funding (€)
Universidad APEC *	Travel and Subsistence Costs	10.000,00 €	10.000,00 €
Universidad Tecnológica de Panamá	Travel and Subsistence Costs	4.545,00 €	4.545,00 €
ESPOL	Meetings, changes of experience between member countries of the project	3.000,00 €	3.000,00 €
Istituto di Tecnologie Avanzate per l'Energia	Exchange of expertise among EU and Lac partners	10.000,00 €	10.000,00 €
Åbo Akademi University	Travelling to project meeting and conference	19.500,00 €	13.650,00 €
Università di Padova, Italy	Travel and Subsistence Costs for Anaerobic Biodigester Plant, Project Hydraulic Design and tech.Development concerns socialization and Mechannical Project supervition	6.000,00 €	6.000,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	Travel and Subsistence Costs	6.000,00 €	6.000,00 €
SUBTOTAL		59.045,00 €	53.195,00 €

3.2f. Other Costs

Organisation	Description	Total Cost (€)	Requested Funding (€)
Universidad APEC *	N/A	0,00 €	0,00 €
Universidad Tecnológica de Panamá	N/A	0,00 €	0,00 €
ESPOL	incidentals	2.000,00 €	2.000,00 €
Istituto di Tecnologie Avanzate per l'Energia	No other costs	0,00 €	0,00 €
Åbo Akademi University	TEM and SEM analysis at Abo Akademi	4.500,00 €	3.150,00 €
Università di Padova, Italy	N/A	0,00 €	0,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	N/A	0,00 €	0,00 €

Organisation	Description	Total Cost (€)	Requested Funding (€)
SUBTOTAL		6.500,00 €	5.150,00 €

3.2g. Overheads (Please, check specific national requirements)

Organisation	Percentage Overheads	Total Cost (€)	Requested Funding (€)
Universidad APEC *	0,00 %	0,00 €	0,00 €
Universidad Tecnológica de Panamá	10,00 %	18.500,00 €	0,00 €
ESPOL	6,00 %	10.000,00 €	0,00 €
Istituto di Tecnologie Avanzate per l'Energia	7,00 %	8.723,00 €	8.723,00 €
Åbo Akademi University	76,00 %	112.480,00 €	78.000,00 €
Università di Padova, Italy	0,00 %	0,00 €	0,00 €
UNIVERSIDAD TÉCNICA DE AMBATO , ECUADOR	0,00 %	0,00 €	0,00 €
SUBTOTAL		149.703,00 €	86.723,00 €

4. Executive summary

(for internal ERANET-LAC use only)

This project aims to combine different technological approaches for reducing the environmental impact of agricultural and urban wastes and to obtain valued energy, particularly in **small scale biorefineries** in **municipal slaughterhouses** and others where all the substrates used for the different process come from only two unique sources of feedstock: solid organic waste and wastewater from the production of a distillery and waste grease from waste organic waste, rendered animal fats and organic residues. Whenever each technology working, either separately or in combination in a biodigestor as a biorefinery part, they present several scientific and technological challenges under a performance point of view, and claim for the implementation of optimization and process control techniques in order to guarantee their performance and to reach sustainability. The design and implementation of appropriate control and optimization strategies will be also be considered. We are presenting one technological development for biogas biodigesters sustainable, biomethane and compost production with a potentiation in the digestion process; it is increasing efficience and quality, using a higher temperature mature through a hot water High temperature Biogas Fuel Cell exchangers. The Reactor thermofilic phase where anaerobic bacteries may have better performance, with a maximum at 54º C, improves the reactor efficience. Otherwise, we are also able for obtaining one plus else for the injecting and feeding recycling industrial CO2, in order to get and improve more biogas production from the anaerobic phase, when bacteries are producing CO2 and generating heat. In the biodigestion acid phase, the acids are becoming in: acetacts, H2, and CO2. This H2 is then used by anaerobic batteries for methane producing in the biodigestion new stage [CVV-GTZ 15].

TECHNICAL DESCRIPTION OF THE PROJECT

5. Publishable summary of the project

(this summary will be used solely for publication purposes)

This project aims to combine different technological approaches for reducing the environmental impact of agricultural and urban wastes and to obtain valued energy, particularly in **small scale biorefineries** in **municipal slaughterhouses** and others where all the substrates used for the different process come from only two unique sources of feedstock: solid organic waste and wastewater from the production of a distillery and waste grease from waste organic waste, rendered animal fats and organic residues. Whenever each technology working, either separately or in combination in a biodigestor as a biorefinery part, they present several scientific and technological challenges under a performance point of view, and claim for the implementation of optimization and process control techniques in order to guarantee their performance and to reach sustainability. The design and implementation of appropriate control and optimization strategies will be also be considered. We are presenting one technological development for biogas biodigesters sustainable, biomethane and compost production with a potentiation in the digestion process; it is increasing efficience and quality, using a higher temperature mature through a hot water High temperature Biogas Fuel Cell exchangers. The Reactor thermofilic phase where anaerobic bacteries may have better performance, with a maximum at 54º C, improves the reactor efficience. Otherwise, we are also able for obtaining one plus else for the injecting and feeding recycling industrial CO2, in order to get and improve more biogas production from the anaerobic phase, when bacteries are producing CO2 and generating heat. In the biodigestion acid phase, the acids are becoming in: acetacts, H2, and CO2. This H2 is then used by anaerobic batteries for methane producing in the biodigestion new stage [CVV-GTZ 15].

6. Scientific and technological challenge

Our proposal aims to implement the design of an experimental unit that allows the evaluation of residual biomass or blends of it; and enables technological adaptation in agricultural areas of the country as a mechanism to generate added value products from residual biomass.Additionally, the residual solids will be dried before gasification, pyrolysis, or composting. The proposed system objective is to innovate in the evaluation and estimation of biogas, syngas, bio-oil and biochar production through the development of equipment that are able to work with an ample range of residual biomass or blend of it.

7. Technical and scientific description of the project

As a common problem for our countries this project relevance takes as example that in Ecuador the National Energy Institute in 2014, estimates that the country waste production (residual biomass) for that year was 2,875,810,670 t / year of livestock residual biomass, 4,323,14.73 t / year forestry residual biomass and 2,550,351, 672 t / year of agricultural residual biomass. This statistics does not take in consideration neither the addition of 36,000 hectares dedicated exclusively to sugar cane due to the official adoption of bioethanol as biofuel. Nor, the residual biomass due to animal husbandry, specifically bovine, where the government is investing considerable resources.

Description

We propose the design and installation of an experimental system for processing residual biomass or blends of it. This system is going to be installed at the Department of Mechanical Engineering and Production Sciences, specifically in the facilities of the Center for Sustainable Technological Development or another similar ones.

ObjectiveGeneral

Implement the design of an experimental unit for bioprocessing residual biomass generating value-added products.

Objetives Specifics:

1. Develop a protocol to handle, load and blend residual biomass at different stages of treatment.
2. Develop an experimental protocol for sampling residual biomass products at different stages of the biological or thermochemical treatment.
3. Characterize products and subproducts obtained from the various stages of the biological or thermochemical treatment
4. Estimate the correlation between methane production, syngas, bio-oil and biochar produced by residual biomass or blends of it fed to the digester, gasifier or pyrolyzer respectively.
5. Study the biogas, syngas, bio-oil and biochar production rates from each of the of residual biomass or blends of it fed to the digester, gasifier or pyrolizer respectively.
6. Identify the process that present better indicators of biogas, syngas, bio-oil and biochar production from residual biomass of blends of it.
7. Establish physical and chemical parameters affecting the biological or thermochemical process due to the blend residual biomass.
8. Feasibility of scaling up the designed process
9. Feasibility of use residual solids to make biomaterials (parallel study).
10. Slaughterhouse Biodigester infrastructure for Residual Biomas Collection.
11. Pre-treatment effluents Sand and Activate Carbon filters with UV.
12. Co2 collections from fireplaces.
13. Hydraulic driving manure effluents heavy waste.
14. Dry reforming CH4 enrichment of streams from gasification.
15. Anaerobic biogas production by supercritical gasification from organic waste.
16. Separation S/L spoted bed drying.
17. Hi temperature biogas fuel cell installation and testing.
18. H2S remotion filters.
19. Sustainable agriculture facilities in greenhouse by CO2 feedingsyntesis.
20. Clean water
21. Organic mineral granular fertilizer compost
22. Refrigeration system by Hi temp. fuel cell cogeneration
23. Biomethane Hi pressure compresing and storage system
24. Mathematic (Mat-lab, LabView) model
25. Combustion motors and cogeneration.

8. Work plan

Proposed processes for research for our twins anaerobic Biodigesters are represented in Fig. 1 (see Annex).

The principal phases for proposal of project are:

Phase I: Gather information and process indicators: Identification of the residual agro-forestry biomass , characterization of the digestate obtained after anaerobic digestion of the selected residual agro-forestry biomass and estimate the amount of biogas produced using the adequate residual biomass or blends of it.

Phase II: Process equipment design: Design of the anaerobic digester, the gasifier and the pyrolyzer , design an adequate drying system for the residual solids after anaerobic digestion and develop standard methods to operate the anaerobic digestor, gasifier and pyrolyzer

Phase III: Build and start up of the designed equipment: Develop a Standard Operation Procedure for loading, unloading and manipulation of the residual biomass fed to the anaerobic digester, gasifier and pyrolyzer, develop Standard Methods to test the biogas generation, and determine the physical, chemical, and biological parameters of interest in the residual biomass or blends of it. And characterize the process subproducts.

Fase IV: Laboratory studies: Measure biogas composition and determine the amount of methane produced by a determined amount of residual biomass or blend of it fed into the digester.

Evaluation of biogas production depending on the feedstock fed to the digester.

Study the syngas, bio-oil and biochar production in the thegasifier and pirolyzer respectively using the dried residual solids, and, study the possibility of make biomaterials from the dried residual solids after anaerobic digestion.

Phase V: Scaling up and results disseminaton.

9. Transnational/EU-CELAC related benefit & added value

The research program can constitute the basis for novel proposals, due to the exchange of personnel and sharing of “know-how” that can establish new future scientific collaborations.

This proposal is essential in the context of technical, scientific, social and environmental cooperation between Europe and Latin America. The results will directly contribute the Sustainable development of the countries and the reduction of the Green House gases.

10. Exploitation of results and -if applicable- economic impact

Project results may be expected to provide LAC municipalities with a clean and efficient technology for dealing with biomass residues on a small-scale/short-chain way, and to improve the international competitiveness of Caribbean industries in the field of biomass exploitation and disposal.

11. Experience of participants

Universidad APEC (UNAPEC) [coordinator]

Dr. engineer William Ernesto Camilo Reynoso, PhD

• Doctor in computer engineering concentration in systems (GIS) geographic information and geomatics, Universidad Pontificia de Salamanca (UPSA), Spain.

• Dean of engineering and computer science, Universidad APEC 2010-2015.

• Chair / VP of the Council of Deans of the Caribbean, and Board member of LACCEI, 2012-2015.

• Founder member and co-ordinator of the national group (GNEESER) and the International Consortium (CIEESEHR) for energy efficiency Solar, wind, hydro, biofuels, climate change and related

Dr. Cándido Enrique Quintana Pérez PhD.

Universidad Central de Las Villas, Cuba, Ph.D. in Technical Sciences,1996

Universidad Politecnica de Cataluña, Spain, Energy and Climate Change, 2000

University of Ghent, Belgium, Energy and Climate Change, 2004

Quintana, C., (2015). Fracking and sustainable energy. UCE science. Vol. 3, no.2. www.uceciencia.edu.do

Quintana, C., (2015). Climate ride between Lima and Paris. UCE science.Vol. 3, no. 1. www.uceciencia.edu.do

MsC. Cirilo Antonio Marte Abreu
Masters in alternative energies. International University Study Center (UISC), graduates of the University of Cádiz. Spain. October 2006
Master's degree in agricultural economics. Agricultural marketing specialist. Instituto Tecnológico de Santo Domingo (INTEC). 1980
A degree in economics. Universidad Autónoma de Santo Domingo (UASD).1977
40 years of experience in planning, formulation and evaluation of projects, economy and agricultural marketing. Almost 10 in renewable energy
Director Dept. Programmes and projects. Secretary of State for higher education, science and technology (SEESCYT). Feb. sep 2002. 2004.

e) President Center for counseling, support and promotion investment (COAPI). Consulting and advisory firm. 1992 to date.

MsC. Yrvin Rivera

1990-current Director of the school of engineering, Universidad APEC RD

1997-1999 production manager, PRODASA. RD

1998-1999 Advisor to Director-General, Direction General of telecommunications RD

1990-1997 General Manager, Electromechanical services Rivera RD

2009-2010 master in university management, University of Alcalá, Spain

2006-2009 master's degree in Education Sciences, University of Camagüey. CUBA

2003-2006 master's degree in electrical engineering, specializing in electronic communications

Universidad Tecnológica de Panamá (BGP)

Dr. Humberto Alvarez, PhD.

2013-2015 doctor of biological engineering and agriculture, North Carolina State University, USA

SCIENTIFIC PUBLICATIONS

1 James, a., * W. Yuan, M. Cain, and D. Wang. "2015 The effect of air flow rate and biomass type on the performance of an updraft biomass gasifier," BioResources. 10 (2), 3615-3624

2 James, a., * W. Yuan, M. Cain, D. Wang, and a. Kumar 2014. In-chamber thermocatalytic tar cracking in an updraft biomass gasifier. International Journal of Agricultural and Biological Engineering, 7 (6), 91-97.

2015 James, a., and * W. Yuan. 2015 Top-lit updraft gasification - characterization of biochar from a low bulk density biomass. Accepted to be presented at the 2015 ASABE Annual International Meeting, 7/26 - 7/29, 2015, New Orleans, Louisiana. AKNOWETH paper No. 152187923.

2014 James, a., and * W. Yuan. 2014. a novel and efficient method to produce biochar from

low-bulk density Biomass. Presented in 2014 ASABE Annual International Meeting, 7/13 - 7/16, 2014, Montreal, Canada. AKNOWETH paper No. 1907902.

Dr. Arthur James, Ph. D.
2012-2015 Ph. D. in Agricultural and Biologic Engr., North Carolina State University, USA
2010-2012 M. Sc. in Agricultural and Biologic Engr., Kansas State University, USA
PUBLICATIONS
1. James, A., *W. Yuan, M. Boyette, and D. Wang. 2015. The effect of air flow rate and biomass type on the performance of an updraft biomass gasifier," BioResources. 10(2), 3615-3624
Available at:
http://www.ncsu.edu/bioresources/BioRes_10/BioRes_10_2_3615_James_YBW_Effect_Air_Flow_Rate_Biomass_Performance_Updraft_Gasifier.pdf
2. James, A., *W. Yuan, M. Boyette, D. Wang, and A. Kumar 2014. In-chamber thermocatalytic tar cracking in an updraft biomass gasifier. International Journal of Agricultural and Biological Engineering, 7(6), 91-97.
Available at:
https://ijabe.org/index.php/ijabe/article/view/1648/pdf
Cecilio Hernández Bethancourt, Ph. D.

2003, Ph. D. Materials Science and Engr. Universidad Autonoma de Mexico.

Publications

1. Microstructural and Mechanical Study of the Al-20Sn (mass%) Alloy processed by Equal-Channel Angular Pressing by Route C. Materials Transaction 54 (2013). C. Hernández, I.A. Figueroa, C. Braham, O. Novelo-

Peralta, G.A. Lara and G. Gonzalez
2. Microstructure and Texture Evolution of the Al-20Sn Alloy Processed by Equal-Channel Angular Pressing Using

Luis Mogollon, M. Sc.
2012-2013 M. Sc. in Electrical Engr. with emphasis in Renewable Energies, University of Arkansas
2010 Electrical and Power Engr., Universidad Tecnologica de Panama
Associate researcher at Universidad Tecnologica de Panama

Orlando Melgar, B. Sc.
2012 B. Sc. in Mechanical Engr., Universidad Tecnologica de Panama
Currently pursuing the M. Sc. in Mechanical Engr. with concentration in Renewable Energie

ESPOL (BIOLRE)

Emérita Delgado Plaza :PhD . Doctor in Renewable Energies and Sustainability .and . Master in Renewable Energies and Sustainability. University Santiago de Compostela. Mechanical Engineer , Escuela Superior Politécnica del Litoral.

PROJECTS : Pilot Program for the production of Biopetróleo and its derivatives from microalgae as a mechanism for the reduction of subsidies and replacement of fossil fuel, PCI . *Technological Transfer and Energy Recovery Of Biomass Algar and stalk, PCI * Development of sustainable communities within the objective of UNESCO for Central and South America. * Construction and analysis of a digester. POAS2016.

Publications: Design of a hybrid kitchen for rural sectors. Magazine .INER- Ministry of Electricity and Renewable Energies. * Analysis of a system of low enthalpy geothermal energy for drying applications* Development of systems for the removal of pure vegetable oil of Jatropha Curcas for direct use as fuels or for manufacturing of biodiesel * Modeling and Analysis of driers with application to Alternative Energy Sources using Simulation Program* Experimental Study and Heat Transfer Process Modeling In The Solar Dryer With Agricultural and Marine Products.. Design and operation of a prototype for drying of biomass.

Juan Peralta Jaramillo :PhD . Doctor in Renewable Energies and Sustainability . University Santiago de Compostela. Master in Renewable Energies and Sustainability. University Santiago de Compostela specialization: Renewable Energy and Energy Sustainability. Mechanical Engineer , University: Escuela Superior Politécnica del Litoral.

Publications : *Energy ASSESSMENT AND STATISTICAL ANALYSIS OF THE REGIME OF WINDS OF Ecuador coastal profile * Statistical analysis of the WEATHER INFORMATION FOR THE EXPLOITATION OF RENEWABLE ENERGIES IN ECUADOR, First International Congress and Expo Scientific, Research Sustainable: Renewable Energies and Energy Efficiency * The USE OF SOLAR ENERGY AND EXCHANGER buried as a source of heat for drying chambers. First International Congress and Expo Scientific, Research Sustainable: Renewable Energies and Energy Efficiency. *Design AND ANALYSIS OF A SYSTEM OF INCINERATION EXPERIMENTA. .

Cesar Moreira Valenzuela :PhD: Biological Engineering (GPA 3.61) - Minors: 1) Environmental Engineering; 2) Mechanical Engineering Master of Science: Biological Engineering (GPA 3.75) - Minor: Environmental Engineering. Bachelor of Science: Biological Engineering (GPA 3.60)

PUBLICATIONS: Cultivation and Optimization of Saline Microalgae BG0011 for Production of Biofuels and Bioproducts * Adaptation of Mesophilic and Thermophilic Anaerobic Digester to Saline Conditions * Development of a Production System for Natural Renewable Gas Using Synechococcus sp. * Development of an Integrated Algal Biorefinary for Polysaccharide and Biofuel Production

Rómulo Vinicio Salazar González: PhD in Food and Bioproducts Science ,AgroParisTech, Paris – France. Master Science in Bioengineering, University of Montpellier, Montpellier – France. BSc in Food Industry Engineering ,Universidad Técnica Particular de Loja, Loja – Ecuador.

PUBLICATIONS : Propiedades físico-químicas de cinco especies frutales del Sur del Ecuador para su industrialización. . *Identification of potencial migrants in Poly(lactic acid) packagings. Italian Journal of Food Science.* Plasticization of Poly(lactide) by sorption of volatile organic compounds at low concentration.

Polymers Degradation and Stability.* . Interactions of flavoured oil in-water emulsions with Polylactide. Food Chemistry

Miguel Ángel Quilambaqui Jara:PhD. Doctor in Agronomy. Universidade Estadual Paulista "Julio de Mesquita Filho" Produção Vegetal Department. Brazil. Master in Plant Pathology, Graduate School. Mexico. Agricultural engineer. Agrarian University of Ecuador. Agriculture Technologist. Agriculture Technology Program. ESPOL.

PUBLICATIONS. He has published more than 11 articles at national and international level on issues Agricultural Extension, Community Development, Plant Health Diagnosis in agricultural crops, use of zeolites in agriculture.

Istituto di Tecnologie Avanzate per l'Energia (ITAE)

Dr. Giuseppe Bonura, PhD giuseppe.bonura@itae.cnr.it
BIOGRAPHICAL DATA
Born in Messina, Italy, October 4, 1978.

EDUCATION
2002 - Laurea in Industrial Chemistry, University of Messina, Italy.
2009 - Ph.D. in Chemical Technologies and Innovative Processes, University of Messina, Italy.

PROFESSIONAL EXPERIENCE
2008-Present: CNR-ITAE "Nicola Giordano", Messina, Italy, Temporary Researcher (Lev. III).
Currently, Dr. Bonura is responsible for the research CNR module "Production of synthetic fuels from fossil sources and CO2". He is also responsible for several WP activities in the frame of research programmes on National or International Commitments. He is a regular reviewer of manuscripts from international journals dealing with hot topics on industrial chemistry and catalytic processes.

MAIN SCIENTIFIC INTERESTS
Dr. BONURA's research activity is mainly focused on the field of heterogeneous catalysis. The main topic of his studies concerns the development of catalytic systems for the production of synthetic fuels and clean alternative fuels, as well as the identification of relationships among chemical and physical properties of catalysts and their catalytic behaviour assessed in reactions of remarkable scientific and applicative interest, as follows:

- Production of methanol and DME;
- Production of synthetic fuels from CO2-rich syngas (GTL processes);
- Production of hydrogen by reforming of oxygenated compounds;
- Production of biodiesel by transesterification of vegetable oils;
- Synthesis of oxygenated additives (acetals and glycerol ethers) for diesel fuels;
- Upgrading of pyrolysis oils into biofuels for automotive;
- Supercritical water gasification of waste biomass for methane production.

MOST RELEVANT PUBLICATION IN THE LAST FIVE YEARS

1. R.K. Chowdari, A. Narani, A. Kloekhorst, C. Cannilla, **G. Bonura**, F. Frusteri, K. Barta, H.J. Heeres. *Solvent free depolymerization of Kraft lignin to alkyl-phenolics using supported NiMo and CoMo catalysts. Green Chemistry 17 (2015), pp. 4921-4930 (Print ISSN: 1463-9262; Online ISSN: 1463-9270).*

2. F. Frusteri, M. Cordaro, C. Cannilla, **G. Bonura.** *Multifunctionality of Cu–ZnO–ZrO2/H-ZSM5 catalysts for the one-step CO2-to-DME hydrogenation reaction.* Applied Catalysis B: Environmental 162 (2015), pp. 57-65 (ISSN: 0926-3373).

3. A. Narani, R.K. Chowdari, C. Cannilla, **G. Bonura**, F. Frusteri, H.J. Heeres, K. Barta. *Efficient catalytic hydrotreatment of Kraft lignin to alkylphenolics using supported NiW and NiMo catalysts in supercritical methanol.* Green Chemistry 17 (2015), pp. 5046-5057 (Print ISSN: 1463-9262; Online ISSN: 1463-9270).

4. **G. Bonura**, M. Cordaro, C Cannilla, F. Arena and F. Frusteri. *The changing nature of the active site of Cu-Zn-Zr catalysts for the CO2 hydrogenation reaction to methanol.* Applied Catalysis B: Environmental 152-153 (2014), pp. 152-161 (ISSN: 0926-3373).

5. **G. Bonura**, M. Cordaro, L. Spadaro, C. Cannilla, F. Arena and F. Frusteri. *Hybrid Cu-ZnO-ZrO2/H-ZSM5 system for the direct synthesis of DME by CO2 hydrogenation.* Applied Catalysis B: Environmental 140–141 (2013), pp. 16–24 (ISSN: 0926-3373).

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Degrees:Dr.Sc., Physical chemistry, 26.4. 1999, Karpov Institute of Physical Chemistry, Moscow, Russia; **Ph.D**., Physical chemistry, 29.5. 1989, Karpov Institute of Physical Chemistry, Moscow, Russia (advisor Prof. M.I. Temkin); **Dipl. Eng.** (M.Sc. Chem. Eng.) 14.2.1986 (with honors, GPA 5.0/5.0), Faculty of Chemical Engineering (1980-1986) (major - Chemistry and Technology in Organic Synthesis) D.I. Mendeleev Moscow Institute of Chemical Technology, Moscow, Russia

Postdoctoral experience: 1995-1996 BASF AG, Germany,1994 ; Åbo Akademi University, Turku, Finland; 1992-1993; Universite Louis Pasteur, Strasbourg, France

Other activities/membership

Chairman of the organizing committee of "Europacat VIII" congress (2007); Representative of Finland in European Federation of Catalysis Societies (2007-2011); Vice –president, European Federation of Catalysis Societies (2009-2013); *Editor*: Catalysis for Sustainable Energy; *Regional Editor for Europe*: Bulletin of Chemical Reaction Engineering and Catalysis; *Editorial board member*: Applied Catalysis. A. General (2007-2010); Bulletin of St. Petersburg State Institute of Technology

Key-note; V Russian conference on zeolites, Zvenigorod, 2008; Chemreactor-18, Malta, 2008; Europacat IX, Salamanca, 2009; CHISA 2010 & European Conference on Chemical Engineering ECCE7, Prague, 2010; International Symposium on Chemical Reaction Engineering ISCRE-22, Maastricht, 2012; IX International Conference: Mechanisms of Catalytic Reactions, St. Petersburg, 2012; Chemreactor - 20, Luxemburg, 2012; 17th International Zeolite Conference, Moscow, 2013; Science of the Future, St. Petersburg, 2014;

Relevant papers

A.V. Kirilin, B. Hasse, A.V. Tokarev, L.M. Kustov, G.N. Baeva, G.O. Bragina, A.Yu. Stakheev, A.-R. Rautio, T. Salmi, B.J.M. Etzold, J.-P. Mikkola, D.Yu. Murzin, Aqueous phase reforming of xylitol over Pt/C and Pt-CDC catalysts: catalyst characterization and catalytic performance, *Catalysis Science and Technology*, **2014**, *4*, 387-401.

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Università di Padova, Italy (UNIPD)

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Università di Padova, Italy.

Ph.D. in Hydrodynamics (Consortium of the Universities of Florence, Genoa, Padua and Trento), 1995

Publications

Piper A.T., Manes C., Siniscalchi F., Marion A., Wright R.M.and Kemp P.S." Response of seaward-migrating European eel (Anguilla anguilla) to manipulated flow fields", *Proceedings of the Royal Society B*, Vol.282, N. 1811, 2015.

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Marion A., Nikora V., PuijalonS., Bouma T., Koll K., Ballio F., Tait S., Zaramella M., Sukhodolov A., O'Hare M., Wharton G., Aberle J., Tregnaghi M., Davies P., Nepf H., Parker G., Statzner B. "Hydrodynamics and ecology: the critical role of interfaces in biophysical interaction", *Journal of Hydraulic Research*, Vol. 52, Issue 6, doi:10.1080/00221686.2014.968887, 2014

Boano F., Harvey J.W.,Marion A., Packman A.I.,Revelli R., Ridolfi L. and Wörman A. "Hyporheic Flow and Transport Processes: Mechanisms, models, and biogeochemical implications", *Review of Geophysics*, doi: 10.1002/2012RG000417, 2014

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Musner T., Bottacin Busolin A. and Marion A. "A contaminant transport model for wetlands accounting for distinct residence time bimodality", *Journal of Hydrology*, vol. 515, 237-246, 2014

Dr. Giuseppe Bonura, PhD

2009 - Ph.D. in Chemical Technologies and Innovative Processes, University of Messina, Italy.

MOST RELEVANT PUBLICATION IN THE LAST FIVE YEARS

1. R.K. Chowdari, A. Narani, A. Kloekhorst, C. Cannilla, **G. Bonura**, F. Frusteri, K. Barta, H.J. Heeres. *Solvent free depolymerization of Kraft lignin to alkyl-phenolics using supported NiMo and CoMo catalysts. Green Chemistry 17 (2015), pp. 4921-4930 (Print ISSN: 1463-9262; Online ISSN: 1463-9270).*

2. F. Frusteri, M. Cordaro, C. Cannilla, **G. Bonura.** *Multifunctionality of Cu–ZnO–ZrO2/H-ZSM5 catalysts for the one-step CO2-to-DME hydrogenation reaction.* Applied Catalysis B: Environmental 162 (2015), pp. 57-65 (ISSN: 0926-3373).

3. A. Narani, R.K. Chowdari, C. Cannilla, **G. Bonura**, F. Frusteri, H.J. Heeres, K. Barta. *Efficient catalytic hydrotreatment of Kraft lignin to alkylphenolics using supported NiW and NiMo catalysts in supercritical methanol.* Green Chemistry 17 (2015), pp. 5046-5057 (Print ISSN: 1463-9262; Online ISSN: 1463-9270).

4. **G. Bonura**, M. Cordaro, C Cannilla, F. Arena and F. Frusteri. *The changing nature of the active site of Cu-Zn-Zr catalysts for the CO2 hydrogenation reaction to methanol.* Applied Catalysis B: Environmental 152-153 (2014), pp. 152-161 (ISSN: 0926-3373).

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PROJECTS: *Characterization of solid waste from Ambato city and estimate of energy potential through thermo-physical analysis. *Estimate of carbon footprint in the development of bus type 1 bodywork.

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PROJECTS: *Characterization of solid waste from Ambato city and estimate of energy potential through thermo-physical analysis.

12. Main facilities and Equipment

Lab-scale (500 cm3) stirred tank reactor (Inconel special alloy) for waste processing under supercritical conditions, equipped with a high pressure pumping system, a 1000 cm3 tank (AISI 304L) for collecting the gas phase and two GC (FID-TCD) for the analysis of both gas and liquid phases.

Experimental set-up for biogas upgrading (methanation), equipped with a continuous fixed bed reactor working at high temperature and pressure (up to 100 bar) and on-line connected to a three columns GC with two detectors for gas analysis.

Many of LAC universities as a research university counts with the following laboratories:

Conversion System,Renewable Energy,CombustionMechanical Design, as example: (CAMPRO)

Center of Biotechnology of EcuadorChemistry Deparment Research Labs, Heat Tranfers and Fluidics Lab, Computational Fluid Dynamics Lab.

In Adition, we have the space necessary to build and start up any equipment developed for this project. Including, administrative office with all the necessary utilities.

13. Status of Consortium Agreement

This project will be part of a consortium lead by Dr. William Camilo, and will be signed on June 2016.

14. Related proposals submitted to other funding agencies

No, this project has not been presented to any funding agency.

Annex

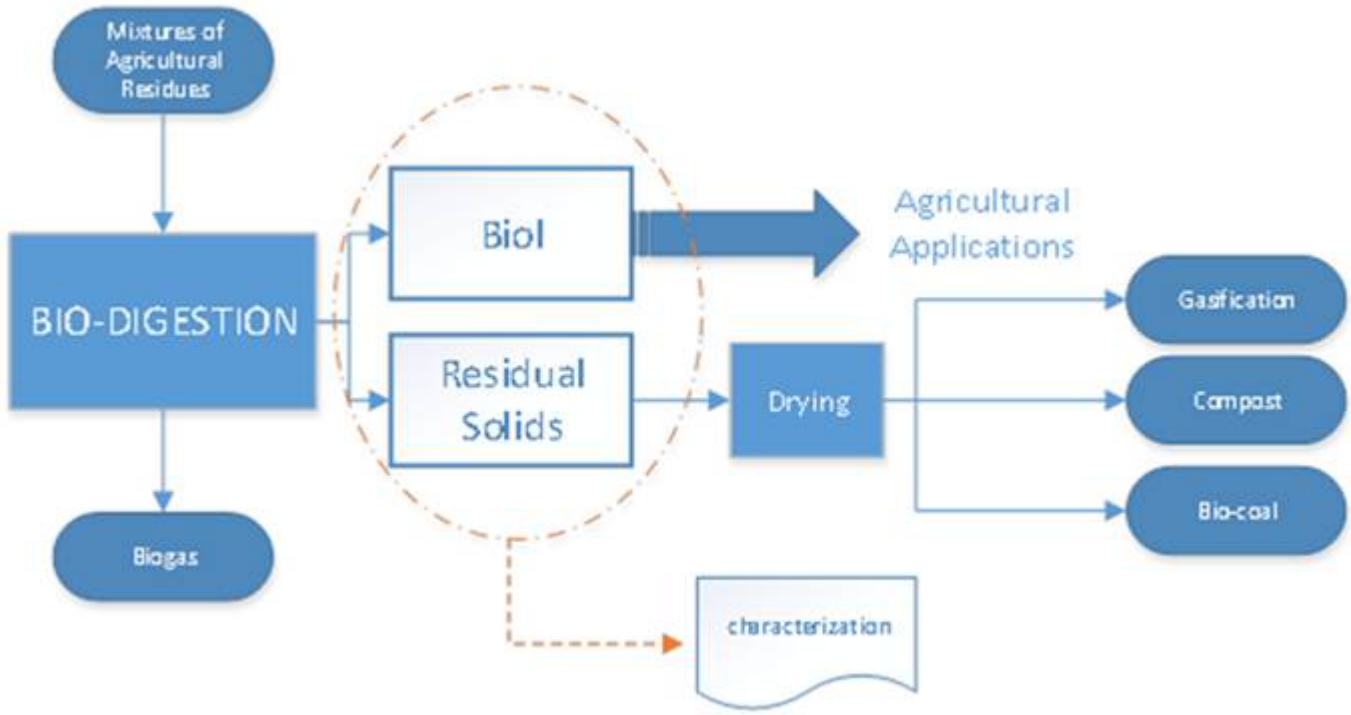

Fig. 1. Principal phases for Biodigester proposal.