

# Edna J. Molina Bacca

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## PROFILE

- Experience in optimization, optimal land-use, renewable energy, costs and statistical analyses, process engineering, and process safety projects.
- Experience in convex, nonconvex & heuristic optimization.
- Proficiency in the use of different mathematical, optimization, geographic, and chemical processes simulation software: R, MATLAB, GAMS, Simulink, ArcGIS and AspenTech tools.
- Excellent oral and written communication skills in English and Spanish.
- Outstanding problem-solving, planning and analytical skills. Reliable, creative, positive, and hardworking professional.

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## ACADEMIC QUALIFICATIONS

- **Master of Science in Chemical Engineering** *November 2018*  
University of Calgary, Calgary, AB- Canada  
**GPA: 3.78/4.0\***
- **Bachelor of Science in Chemical Engineering (5 years program)** *2010 – 2015*  
National University of Colombia, Bogota-Colombia  
**GPA: 4.1/5.0\***

*\*being 4.0 and 5.0 the best possible grades.*

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## EXPERIENCE

**PhD student – Land use optimization** *September 2019-Present*  
Potsdam Institute for Climate Impact Research-RD3

- Modification of MAgPIE framework's factor costs module to reduce the flexibility in capital relocation between crop types, and better capture crop production dynamics at different spatial scales (*ongoing project*).
- Generated routines to be able to compare MAgPIE results with historical values for the assessment of different indicators of the sustainable development goals.

**Research assistant – Modeling of flocculation processes** *September 2018 - July 2019*  
University of Calgary

- Evaluated the optimal conditions needed to make the flocculation of tailings an efficient and cost-effective process through the calculation of microstructural parameters of the aggregates formed between clay, silt, and polymers.
- Generated the necessary data to determine the correlation between rheological and structural parameters of the flocs formed during flocculation of mature fine tailings using image processing (MATLAB), of pictures obtain through laser scanning confocal microscopy, and statistical analysis techniques.
- Conducted data analysis of flocculation experiments for the regression of the parameters of different flocculation models to predict aggregation and settling rates of clay and silt present in the fines of tailing ponds.
- Collaborated with multiple members of the research team in the modeling, statistical analysis, optimization and informed decision making of different water treatment methods.

**Graduate research assistant - Optimal design of microgrids** *May 2016 – August 2018*  
University of Calgary (NSERC and Industrial Partners Funded)

- Created a computer methodology for the selection, location, optimization (LP, MIP, MINLP) and control of intelligent microgrid networks (wind, solar, storage & gas microturbines) integrating ArcGIS, GAMS and MATLAB considering reliability and sustainability parameters.
- Modelled solar and wind energy cost estimates (CAPEX, OPEX, NPV) for long-term investment planning and budget evaluation.
- Analyzed wind curves, wind speed and solar irradiation historical data for estimation of power

generation efficiency.

- Forecasted power demand, renewable resources availability, and energy price utilizing different deterministic based and machine learning functions in MATLAB, Simulink and Excel.
- **Teaching Assistant:** In-class tutorial demonstrations for the 'Process Controls' and 'Applied Numerical Methods' courses.

**Student Intern - Production of chemicals from renewable feedstock** *February 2015 – June 2015*  
Michigan State University

- Evaluated the suitable reaction and sublimation conditions (temperature, pressure, initial concentration of reactants and catalyst volume) to produce furandicarboxylic acid (a biodegradable alternative for PETE) for process engineering applications.
- Analyzed experimental data to identify the side products, and efficiencies of the reaction and purification of the desired product using different analytical chemistry and statistical techniques.

**Student Intern - Process Safety (EH&S)** *June 2014 – January 2015*  
Equión Energía (A Repsol-Ecopetrol Oil and Gas Company)

- Supported the team members of process safety area of the company in the development, technical evaluation, and document creation of different process safety studies, maintenance procedures, and engineering drawings such as MOCs formats, PHA (process hazard analyses), HAZOPs, Risk Assessments, and P&IDs.
- Helped the team in the consistency checking and update of the procedures and policies used in the process safety incidents and accidents investigation in the operations, construction, commissioning, and procurement of the company's facilities.
- Tracked, sorted and evaluated the statistics of the process safety incidents, accidents, and the corresponding investigations that occurred in the facilities of the company for safety and regulatory applications.
- Assisted the process safety team in the planning, scheduling and delivering of the process safety seminars made at different levels of the company.

**Student Intern - Chemical and Biochemical Processes Group** *March 2012 – April 2016*  
National University of Colombia

- Created an algorithm to determine the optimal operation conditions of a reactive distillation process to produce citric acid esters (using a MATLAB-Aspen Plus interface and evolutionary optimization algorithms).
- Collaborated with the multidisciplinary team that worked on the start-up of a pilot plant designed to dehydrate azeotropic ethanol using molecular sieves.
- Identified and analyzed the different substances present in the fusel oils produced in Sucroal S.A. industrial plant (Colombia) using HPLC and GS/Mass Spectrometry.
- Supported the team in the creation of presentations, data gathering, training to use equipment, tours in the pilot plant of the university, and in other activities.
- Assisted the principal investigator in the logistics and planning of the Advanced Separation Operations International Seminar at the National University of Colombia (*Summer 2014*).

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## CONFERENCES AND PAPERS

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### Papers:

- **Molina Bacca, E. J.**, Knight, A., & Trifkovic, M. (2020). *Optimal land use and distributed generation technology selection via geographic-based multicriteria decision analysis and mixed-integer programming*. Sustainable Cities and Society, 55. doi: 10.1016/j.scs.2020.102055
- Govedarica A., Molina Bacca, E.J. & Trifkovic, M. (2020). Structural investigation of tailings flocculation and consolidation via quantitative 3D dual fluorescence/reflectance confocal microscopy. Journal of Colloid and Interface Science, 571. doi: 10.1016/j.jcis.2020.02.098

## Presentations:

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- Optimal Sizing and Placement of the Components of Microgrid Considering a GIS Multicriteria Decision Analysis and Supply Reliability. CSChE 2017 Canadian Chemical Engineering Conference. Edmonton, Alberta.
- Cyclization and Dehydration of Aldaric Acids to 2,5-Furandicarboxylic Acid at the 2016 AIChE Annual Meeting, San Francisco, California.
- Optimization of a Reactive Distillation Process for Producing Triethyl Citrate at the 2013 AIChE Annual Meeting, San Francisco, California

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## ASSOCIATIONS AND VOLUNTEERING

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- **Volunteer at The Calgary Zoo (December 2018-August 2019)**  
Support visitor engagement activities, logistics of events, and data collection for the Zoo's enrichment program improvement.
- **International Society of Automation (ISA) UCalgary Student Chapter President (June 2017- June 2018) and Secretary (July 2016- June 2017).**  
Planned, promoted and executed events related to process control, systems, and modeling at the University of Calgary. Created bridges between the different student's ISA Sections in Alberta. Held by-weekly meetings with the members of the group. Helped create networks between students and professionals from the industry. Lunch & Learn events were held with Suncor, Spartan Controls, Cenovus, GE-Baker Hughes professionals.
- **VP Finance of the Chemical and Petroleum Engineering Grads' Association of the University of Calgary (June 2017- June 2018 Term) and Team member (Volunteer) (June 2016-June 2017).**  
Maintained the group's finances up to date, including budgeting, planning and accounting of the group's funds. Supported the group in the planning, execution and logistics of conferences, presentations, panels with professionals, department's mixers, among others.
- **PADI Open Water Diver certificate:** In progress.