

Engineering X

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Transforming Systems through Partnership



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ACCELERATING MARINE ENERGY IN COLOMBIA

Lead partner: Professor Ramón Fernando Colmenares-Quintero,
Universidad Cooperativa de Colombia

THE CHALLENGE

Harnessing the potential of renewable energy is crucial to meeting the world's energy needs. However, many countries face considerable challenges in terms of developing infrastructure for green energy. In Colombia, two-thirds of the country, known as the Non-Interconnected Zones, have partial or no electricity coverage and are reliant on polluting diesel generators. As well as improving the supply of energy to communities throughout the country, Colombia has committed to generating 74% of its total electricity from renewables by 2030.

Colombia has considerable natural resources, which hold the key to increasing the supply of clean energy throughout the country. Oceans and rivers, which account for over half of the country's territory, have significant potential to generate sustainable energy. Marine energy also has economic and regional development benefits, especially when local manufacturing and community ownership is involved. Improving knowledge and fostering innovation within Colombia and beyond is crucial to developing key technologies, building workforce capacity and generating community support for commercially viable marine energy projects.



THE PEOPLE

Professor Ramón Fernando Colmenares Quintero, Universidad Cooperativa de Colombia

Dr Diana Milena Caicedo Concha, Universidad Cooperativa de Colombia

Dr Adriana Patricia Villegas Quinceno, Universidad Cooperativa de Colombia

Dr Sandy Kerr, Heriot-Watt University

Dr Colin Bullen, Heriot-Watt University

Dr Gareth Davies, Aquaterra

Sir Tom Wills, Aquaterra

Natalia Arure Alvarez Rojas, Aquaterra

THE PROJECT

Addressing Colombia's renewable energy challenges is a complex task. The primary aim of the 'Accelerating marine energy in Colombia' project, which ran from April 2016 to March 2017, was to **develop a capacity-building programme for engineering teaching and research** to support the emerging marine energy industry. Support from the Academy enabled the team at the Universidad Cooperativa de Colombia (UCC) and their partners to **analyse the potential of marine and run-of-river energy in Colombia** and identify gaps in engineering knowledge and skills in the country.

The Industry-Academia Partnership Programme¹ provided the impetus and financial support for

¹ IAPP is the previous version of the Transforming Systems through Partnership programme

UCC to benefit from strategic relationships with a UK university and industry partner. Throughout the project, the UCC team collaborated closely with Heriot-Watt University's International Centre for Island Technology (ICIT) and consultancy firm Aquatera, both of which have extensive international expertise in marine renewable energy. The transfer of knowledge between partners **increased the quality, credibility and impact of the project**. In addition to providing industry experience, Aquatera played a crucial role in helping the Colombian researchers to **build relationships with industry stakeholders**. The 'International workshop on marine and run-of-river energies in Colombia', led by UCC in December 2016, provided opportunities to share research expertise and propose collaborations between academia, industry and government.



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Engaging communities formed a crucial part of the project team's strategy. As well as developing connections with industry, the UCC team met with key stakeholders across Colombia and Latin America, building key relationships and gaining a greater understanding of current policies.

IMPACTS

The 'Accelerating marine energy in Colombia' project **laid the foundations for further work to increase expertise in wave and tidal energy**. UCC and Aquatera, with input from Heriot-Watt, developed a briefing report on Colombia's aquatic renewable energy potential and the engineering expertise needed to expand the industry. This report has attracted the **interest of industry bodies and governments across Latin America**, as well



as academia, and has shaped UCC's activities since. Looking towards the future, the project team also identified **further areas of research and development** that need to be addressed, including technological challenges, strategic and infrastructure issues, and socio-economic benefits for communities.

Working collaboratively with the international community is going to be essential to Colombia's long-term success in developing its renewable energy industry. The project **built productive relationships between Colombian and UK academia and the marine energy industry**, which continue to thrive. UCC has worked closely with Aquatera on several projects since 2017 and maintains close links with Heriot-Watt University.

"This project has enabled the strengthening of collaboration between UK institutions with a track record in marine and run-of-river energy and Colombian educators and researchers looking to gain experience in this area."

Professor Ramón Fernando Colmenares-Quintero, lead partner

The project's impact extended beyond academia and industry, to encompass students and the wider community in Colombia. Both university and high school students benefited from teaching and workshops related to the project. UCC also generated media coverage to raise awareness of marine energy in Colombia.



THE FUTURE

The project's long-term goal was to **support and promote the development of a viable marine energy industry in Colombia**. The progress made through the project has been built on extensively by UCC, other researchers and industry bodies in the past five years. The UCC project team has successfully applied for several grants for research projects that extend the team's work on renewable energy. UCC has also used its growing expertise in renewables to **improve engineering and STEM education** at undergraduate, master's and PhD level in Colombia.

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"The projects ... funded by the Royal Academy for Engineering ... have given us the opportunities for the exchange of practical as well as theoretical experience and the awareness of marine and run-of-river energy R&D potential in Colombia and its development and deployment."

Professor Ramón Fernando Colmenares-Quintero, lead partner

In 2019, lead partner Ramón Fernando Colmenares-Quintero founded the BERSTIC network, which focuses on research and innovation in energy, water, biomass, and smart territories. The network is helping to **change national and regional priorities in Colombia**. UCC has also built relationships with COTECMAR (the Colombian state-owned shipbuilder and engineering company) and Dutch companies Oceans of Energy and Elemental Water Makers.



Academics at UCC have made significant progress **engaging with people in the Colombian Non-Interconnected Zones** (areas of the country with partial or no electricity coverage), including indigenous communities. UCC has also shared its work with a wider audience, through engagement with radio and television channels in Colombia and other Spanish-speaking countries. Outreach work

with school students has continued, **including in indigenous communities**. Moreover, as part of its wider education programme, the team at UCC has developed a videogame that asks young people to 'Save the Earth'² and introduces them to the Sustainable Development Goals.



SOURCES:

This impact case study was prepared using information from interviews with the project team, documents supplied by the Academy including reports, and additional online resources.

- Application for IAPP funding
- Aqatera and Universidad Cooperativa de Colombia (2017) 'Accelerating Marine Energy in Colombia', Report.
- Website: <https://berstic.edu.co/>
- Quarterly reports
- Final report
- Interview with Professor Ramón Fernando Colmenares-Quintero

² <https://youtu.be/BticUwBk-Fw?si=ZwRtl5LOHXbJAxv6>



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