ABSTRACT

Systemic perspectives on low-carbon cities in Colombia-
An integrated urban modeling approach for policy and regulatory analysis

ENGLISH

The project proposes a methodology and a toolbox to support urban sustainable development through a sectoral approach applied in two case studies. The sectors involved are: (i) urban ecology; (ii) integrated water management; (iii) energy (decentralized supply and consumption); (iv) waste management; (v) sustainable mobility; and (vi) buildings and infrastructure. The selected case studies are: (i) Ciudad Verde in the municipality of Soacha (Cundinamarca), a large-scale urban project currently in operation phase: and (ii) Lagos de Torca, an urban development project in design stage and starting its construction.

The developed approach proposes the ecological structure and the integrated water management as articulating axes of urban planning to contribute to the conservation and sustainable management of resources, good land use, life-quality improvement, and social and gender inclusion. Each sector: i) defines a set of desired objectives for the development of urban projects; ii) identifies the current state of the project; and iii) designs and assesses options aimed to reduce carbon footprint, increase resilience, and improve life-quality and habitability conditions for residents.

Considering that the urban projects are dynamic, a sectorial indicator set is defined to characterize the current situation of a project and its evolution towards an urban development sensitive to the purposes of sustainability. The indicators set, one of the pillars of the proposed toolbox, are estimated or measured (according to the case). Using the methodology *Fuzzy Comprehensive Evaluation Method* (FCEM), it is possible to obtain a global assessment of the urban project in line with objectives set by the stakeholders. Another pillar of the toolbox is the set of models to evaluate: i) indicators; ii) mitigation options for green house gases (GHG) emissions and other contaminants; iii) adaptation actions to reduce the project vulnerability to changes in the climate or hydrometeorological events; and iv) alternatives to improve living conditions of the residents. This analysis seeks to evaluate options that lead to the achievement of the sustainable development goals.

Most of the sectorial models selected are open source. To assess the different improvement options, baselines are built from primary data collected through surveys and focus groups for the first case study, and secondary data provided by the developers of each project for the second case study. A methodology for GHG emissions inventories of urban projects (suitable to cities) has been developed to evaluate the GHG emissions mitigation options (reduction potential and cost – efficiency). Also, a portfolio integration tool has been developed to evaluate the cost-efficiency of the options, compile other results as co-benefits, and facilitate its visualization.

The project has been divided into two phases. In the first phase, the methodology and the toolbox proposed have been applied to two case studies. The second phase intends to transfer the methodology proposed, in order to be used in different case studies in intermediate cities with different geographics, meteorological, and urban development conditions. This phase has the support of regional entities, and it is developed with local universities. Furthermore, seeking to maintain the link of the project with Colombian government programs, some of the selected cities are related to the *Biodeverciudades* program led by the Ministry of Environment and Sustainable Development.

The main result of the project is a white paper that summarizes the main results, and proposes suggestions for the planning of urban projects. It includes recommendations about policies and regulations, coordination and management, financial sources of the solutions, and the creation of capacities and innovations to contribute to sustainable urban development in the country. This proposal arises from the results obtained, the barriers identified in the analysis, and a review of the national institutional framework and internationally successful case studies.

During the first phase of the project, a group of 25 members participated. These professionals include professors, postdocs, and research assistants from the Schools of Engineering and Architecture, as well as the Center for Sustainable Development Goals at Universidad de los Andes. Also, 2 professors from University College of London, and one from the Coventry University in the UK, three professionals from the Colombian Council for Sustainable

Construction, and three external consultants. The project has received the advice of a committee composed by 6 national and international experts, and an institutional committee with representatives of governmental entities. Also, it has had the support of managers and developers of the urban projects selected as case studies. This project is funded by the program UK-PACT Colombia.