

Estimating the Climate Value of Bicycling in Bogotá, Colombia, using a Shadow Pricing Methodology

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The reduction of CO₂ emissions forms one of the largest challenges of the current era. Sustainable transport projects aim at reducing emissions by (1) 'Avoiding' motorized mobility, (2) 'Shifting' motorized mobility to zero-emission alternatives or (3) 'Improving' efficiencies in the current transport system. Especially bicycling is suitable for 'Shift' projects because bicycles have a zero-emission value. Development of bicycle projects, however, is hampered caused by a lack of insight in the economic benefits arising from bicycling. With the introduction of the Clean Development Mechanism (CDM) and the Voluntary Carbon Markets (VCM) an extra stimulus for sustainable development, in the form of additional project revenues produced by the sale of CO₂ emission reduction credits (CERs) is created. Little scientific research has been conducted to the appraisal of the CO₂ reduction potential of bicycling. This research explores the possibilities of the CO₂ assessment of bicycling by the development of the Shadow Traffic Model.

The Shadow Traffic Model is a traffic evaluation model based on the economic principle of shadow pricing. Bicycle mobility represents a CO₂-sink in which each bicycle trip is a potentially emitting trip when made with a motorized transportation mode. Shadow pricing enables the estimation of the value of this CO₂-sink resulting in the Climate Value of Bicycling. The Shadow Traffic Model substitutes bicycle trips by their most likely alternative transportation modes, based on the choice probability distributions given by modal splits specified to trip length, socio-economic background and purpose combinations. This results in the Shadow Traffic Performance of bicycling. Subsequent emission modeling with transportation mode specific emission factors results in the Climate Value of Bicycling. When traded on the CDM and VCM carbon markets this climate value represents an monetary asset.

Application of the Shadow Traffic Model to the case study Bogotá, Colombia, a city with a bicycle modal share of 3.3 % on a total of 10 million daily trips, results in a Climate Value of Bicycling of 55.000-62.000 tCO₂ per year corresponding with an economic value of \$ 1.1-1.3m when traded on the carbon markets. A hypothetical increase in the bicycle modal share to 15 % leads to a value of 0.35 MtCO₂ per year representing an annual carbon finance revenue of \$ 7.1m.



Bicycling in Bogotá, Colombia (Source: CCB, Movilidad en bicicleta en Bogotá, 2009)



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