

## JUAN BENAVIDES ESTÉVEZ-BRETÓN

[benavides.jm@gmail.com](mailto:benavides.jm@gmail.com)

### COLLEGE EDUCATION

**Ph. D.**, Mineral Economics. The Pennsylvania State University, University Park PA. 1991-1995. Thesis: "Optimal Pricing and Investment in Electric Power Generation in the Context of Uncertainty."

**Specialist**, Advanced Mathematics. Universidad Nacional de Colombia, Bogotá, Colombia. 1985-1988.

**Specialist**, Energy Systems Management. Universidad de los Andes, Bogotá. 1987-1988.

**Electrical Engineer**. Universidad de los Andes. 1973-1977.

### PROFESSIONAL POSITIONS HELD

**Member, Vice-presidential Commission of Infrastructure Experts**. Appointed to this task force created by the Vice-President of Colombia to advise on transport policy. 2019.

**Member, Presidential Commission for Science, Technology and Innovation**. Coordinator of the Sustainable Energy Group. Appointment by the President of Colombia. 2019.

**Distinguished Professional**. School of Government. Universidad de los Andes. July 2018-May 2019.

**Corporate Innovation Strategist**. Business transformation of large corporations. Startup design, funding and mentoring. June 2016-.

**Associate Researcher**. Fedesarrollo. February 2015-. Technical Leader of the Colombian Transportation Master Plans 1 and 2 for the Vice-presidency of Colombia and the Ministry of Transportation. Policy papers in energy, telecommunications and transport infrastructure.

**Member of the Directive Council**. National Infrastructure Agency of Colombia (ANI). January 2015-March 2019.

**Director**. CELSIA (electricity sector company). Member of the Board of Directors between March 2009-March 2017.

**Strategy Advisor**. IE and International Gas Supply Corp. August 2014-January 2015. Corporate strategy of a holding company and Member of the Board of Directors of 6 subordinate companies.

**Director**. Interdisciplinary Center for Development Studies (CIDER). January 2013-July 2014. Universidad de los Andes, Bogotá. Professor of Mining, Growth and the Environment (master's course), Game Theory in Economic Development (undergraduate elective) and Leader of the MOOC course (in alliance with the IDB, released in edX) *Water: Latin American Abundance, Global Scarcity*.

**Deputy Dean for Research**. School of Engineering, June 2011-December 2012. Universidad de los Andes, Bogotá. In charge of the Ph. D. Program. Professor of Dynamical Systems and Businesses on Technological Platforms.

**Member, Advisory Committee on Project Structuring**. National Infrastructure Agency of Colombia (ANI). Report to ANI's Board of Directors. May 2012-March 2019.

**Member, Presidential Commission of Infrastructure Experts**. Appointed to this task force created by the President of Colombia to advise on transport policy. 2012.

**Associate Professor**. School of Management, January 2007-May 2011. Universidad de los Andes, Bogotá. Member of the Finance Group. Lecturer of the Ph. D. Program in Management (Contract Theory, Theory of the Firm, Game Theory) and the Ph. D. Program in Economics (Mathematical Methods). Research focused on energy policy, regulated industries, the

economics of contracts and infrastructure financial arrangements. Professor of Project Financing, Corporate Finance, Real Options. Adviser of three Ph.D. theses.

**Senior Infrastructure Specialist.** (Sustainable Development Department, Inter-American Development Bank, IDB). Washington, D. C. July 2004-December 2006.

Continuation, deepening and extension of tasks and responsibilities undertaken in the previous role of Infrastructure Specialist at the IDB.

Achievements (other than publications and support to loan operations) include:

- Commissioned to support the Colombian Government in the start-up of its National System of Competitiveness (June-September 2006).

- Organizer and Technical Coordinator of the Seminar "Business Climate for Private Infrastructure Investment in Latin America." Annual Meeting of the IDB. Belo Horizonte, Brazil, April 2, 2006.

- Team Leader of the Operation to write the Manual: Cost-Benefit Analysis in Transport Projects with the Universidad de Las Palmas de Gran Canaria (Spain).

- Team Leader of the Operation to support the integration of gas markets in South America. Representation of the IDB in Ministerial Meetings held at Montevideo, Buenos Aires, Asunción and Lima between June and October 2005.

- Co-organizer of the joint IDB-World Bank conference "Infrastructure in Latin America: Recent Evolution and Key Challenges", Washington, D.C., June 6, 2005. In charge of the session on the political economy of social acceptance of reforms.

**Infrastructure Specialist** (Sustainable Development Department, Inter-American Development Bank). Washington, D. C. August 2000-June 2004.

- Eligibility and credit review of bank operations in infrastructure (loans, guarantees and technical cooperation; both private and public; about 75 projects in 21 countries).

- Assessment, review and recommendations of/for assigned Bank policy documents; preparation of inputs for several policies, strategies and guidelines (including Energy, Water and Sanitation and Natural Disasters).

- Analytical work in (i) contracts, financial structures, governance mechanisms and regulation in transport, electricity, gas, telecoms and transnational infrastructure projects; (ii) political economy analysis and institutional recommendations for electricity reforms; and (iii) rural infrastructure. Commissioning and supervision of about 20 applied research papers. Editor of 5 issues of the *IFM Bulletin*.

- Organization of international conferences, including the Washington and Lima IDB 2004 seminars on *Increasing Infrastructure Investments in Latin America and the Caribbean*; and of internal workshops (Regulation and Finance of Transnational Infrastructure Projects, 2001).

- In-the-field advice to operations and tasks in 15 countries of the Region, including: a Policy-Based loan for Colombia; support to the World Bank Team in charge of a Colombia Sustainable Development SAL/TAL for Colombia (2004); a multi-sector infrastructure loan to Haiti (2003); and advice to the Sub-commission of Transport Concessions of Plan Puebla-Panama (2003).

- Support to drafting Memorandums of Understanding between the IDB and the Western Hemisphere Transportation Initiative (WHTI), and between the IDB and the International Civil Aviation Organization (ICAO).

- Representation of the Bank in international technical seminars and policy-making events.

- Representation of the Sustainable Development Department in internal committees and panels, including Quality at Entry Exercises (2003, 2004, 2005), peer review of several Loan Committee projects and Internal Evaluation of Transportation Projects (2005).

**Associate Researcher.** Fedesarrollo. Bogotá. November 1999-July 2000. Infrastructure and Energy Economics.

**External Professor.** Ph. D. Program, Department of Economics, Universidad Nacional de

Colombia, Bogotá. First Semester, 2000 (The Economics of Contracts); First Semester, 2001 (Evolutionary Game Theory); Second Semester 2002 (Evolution of Institutions); Second Semester 2004 (Political economy: redistribution and property rights).

Master's Program in Regulation, Universidad de Los Andes, Bogotá. Second Semesters of 2003, 2004, 2005 and 2006 (Module on The Political Economy of Infrastructure Regulation). Latin American University Regulation and Infrastructure Network (LAURIN).

**Visiting Professor.** Department of Economics and Enterprise, University of Salamanca (Spain). March-May 1999. Seminars on Industrial Organization and the Economics of Contracts.

**Associate Professor.** Department of Industrial Engineering, August 1995-July 2000. Universidad de los Andes. Master's Courses taught: Nonlinear Programming, Dynamic Programming, Investment under Uncertainty, Industrial Organization, Game Theory, Regulation Theory, Economics of Contracts. Undergraduate courses taught: Stochastic Processes, Linear Programming, Discrete Time Finance. Adviser of more than 20 master's theses and 60 undergraduate theses in real and financial options, mechanism design, regulation and mathematical modeling.

**Assistant Professor.** Department of Electrical Engineering, 1989-1991. Universidad de los Andes, Bogotá. Courses taught: Linear Systems, Signal Processing, Information Theory, Circuit Theory, Energy Economics, Algebraic Control Theory.

**Director,** Energy Group. 1990-1991. Universidad de los Andes, Bogotá. Coordination of the Energy Systems Management Graduate Program (joint program with the United Nations University in Tokyo).

**Studies and Projects Engineer.** Electrolima, Ibagué, Colombia, 1981-1988. Electric power systems planning, operations planning, and control center coordination; distribution network design.

**Assistant Engineer.** Electrolima, Prado Hydro-Power Plant, Colombia, 1978-1981. Plant operation, maintenance coordination, time series hydrological modeling.

**Software Engineer.** Schiemann, Kraus and Company, Bogotá, 1977. Management Information Systems design and implementation.

## **CONSULTANT AND RESEARCH EXPERIENCE IN RENEWABLE ENERGY, ENERGY POLICY AND REGULATION DURING 2016-2019**

2019. Market Architectures for Decentralized Energy Resources (DER) Deployment in Developing Countries. Concept note prepared for the World Bank.

2019. Cost-benefit analysis of the interconnection between Puerto Bahía and the Cartagena Refinery. Fedesarrollo.

2019. Recommendations for the Mercantile Exchange of Colombia in its role of Gas Market Manager.

2018. Coordinator of the National Development Plan of the Colombian government 2018-2022. In charge of infrastructure, energy, competitiveness and telecommunications issues.

2018. Recommendations for the Ministry of Mines and Energy of Colombia about the renewable energy auction design in Colombia. Inter-American Development Bank. October-November 2018.

2018. Decentralized Energy Resources (DER) policy note, with a preliminary discussion for application in Africa. Concept note commissioned by the World Bank.

2018. Background support to Power Auctions for the design of the first auction for introducing renewable energy sources in the Colombian electricity market. Consultant for the World Bank. January-June 2018.

2017. Review and testing of the English auction algorithm to allocate natural gas contracts in Colombia for Dataifx (software company). August-November 2017.

2017. Assessment of the electricity generation opportunities of an integrated oil and gas company in Colombia. Review of proposals for A.T. Kearney (Bogotá Office).
2017. Technical support to the “Flagship Report: Energy Markets in Latin America and the Caribbean – Emerging Disruptions and the Next Frontier” of the World Bank.
2016. “The political economy of disrupted electricity sectors in Latin America. Transition phases and broad policy measures to foster cleaner energy and new business models.” Working paper commissioned by the World Bank. Co-authored with Gabriela Elizondo.
2016. Discussion of the regulatory proposal to remunerate transport pipelines (WACC) in Colombia. Document commissioned by Naturgas (Association of natural gas regulated firms).

Published papers in energy:

- Benavides, J, Á. Cadena, J. J. González, C. Hidalgo and A. Piñeros. 2018. “Mercado eléctrico en Colombia: transición hacia una arquitectura descentralizada.” Fedesarrollo. Available at: <https://www.repository.fedesarrollo.org.co/handle/11445/3673>
- Cabrales, S., R. Bautista and J. Benavides. 2017. “A model to assess the impact of employment policy and subsidized domestic fuel prices on national oil companies.” *Energy Economics* 68: 566-578. Available at: <https://www.sciencedirect.com/science/article/pii/S0140988317303791>

**COST-BENEFIT AND ECONOMIC IMPACT ANALYSIS OF TRANSPORT INFRASTRUCTURE PROJECTS FOR MULTILATERAL INSTITUTIONS SINCE 2007**

- IDB. 2019. Cost-Benefit Analysis of Eje IV Integration Road between Perú and Ecuador,
- IDB. 2018. Project Completion Report and macroeconomic impact of Operation PN-L1151 (transport and logistics in Panama).
- IFC. 2017. Support to review the SAM-based impact estimation model of transport and energy models financed for the International Finance Corporation (IFC). Commissioned by the Modeling Team of the IFC.
- IDB. 2016. Review of the benefit-costs analysis of the international tunnel Paso de Agua Negra (Argentina-Chile). Operation RG-L1074.
- IDB. 2016. Macroeconomic impact of the reform of transport and logistics in Panama. Operation PN-L1119.
- IDB. 2016. Economic impact of the Program of Public-Private Partnerships in Colombia. Operation CO-L1162.
- IDB. 2016. Development of an analytical background and quantitative estimation of road asset management impact on capital formation in Haiti. ATN/OC-1401-HA.
- IDB. 2016. Methodology and calculation of the economic impact of the Caracol Road in Belize. Operation BL-1022.
- IDB. 2015. Economic Analysis of the Program to support the reform of transport and logistics in Panama. Operation PN-L1110.
- Fedesarrollo. 2015. Economic Analysis of Rio Magdalena’s program for river transportation (Colombia). Support for the CBA component. With Helena García and Felipe Castro.
- IDB. 2014. Estimation of exogenous benefits generated by a road project in RAAS Region (Nicaragua). Operation NI-L1087. With Raúl Castro.
- IDB. 2013. Economic Analysis of the Program to support private participation in infrastructure in Colombia. Operation CO-L1131.
- IDB. 2013. Economic Analysis of the Program to support the national policy of road safety. With Luz Janeth Forero, Manuel Rodríguez and Ana María Pinto.

- IDB. 2012. Economic Analysis of the Program to support the implementation of the National Logistic Policy in Colombia. Operation CO-L1109.
- CAF. 2010 and 2011. "Evaluación económica de proyectos de infraestructura." On-line course developed with Antonio Vives (leader) for Latin American public officers. Web platform support: CEDDET (Madrid, Spain). Project sponsored by Corporación Andina de Fomento. Design and delivery of 2 versions.
- "Evaluación económica de proyectos de transporte." 2010. Project led by Ginés de Rus (Universidad de las Palmas de Gran Canaria). Funded by Ministerio de Fomento de España. Participation as Invited Researcher. Available at:  
<http://www.evaluaciondeproyectos.es/EsWeb/Resultados/Manual/PDF/EsManual.pdf>
- CAF. 2009-2010. "Selección, evaluación y mejoramiento del impacto de proyectos de infraestructura." Antonio Vives and Juan Benavides. Workshops conducted at Buenos Aires, Quito and Caracas for public officers and Corporación Andina de Fomento (CAF) staff.
- IDB. 2008. Cost-Benefit Analysis of Road Project Variante Pasto – Mocoa in Colombia. Operation CO-L1019.
- IDB. 2007. Drafting of a Technical Cooperation Document to support the energy component (Provincia de Entre Ríos, Argentina). Operation AR-L1036.

#### **OTHER CONSULTANT EXPERIENCES SINCE 2007**

2019. Coordinator of the Infrastructure Master Plan of El Salvador. Interamerican Development Bank.
2020. Vertical integration analysis in the Colombian health sector. Commissioned by the Ministry of Health,
2018. Coordinator of the National Development Plan of the Colombian government 2018-2022. In charge of the energy sector policy brief.
- 2017-2018. Team member. Logistic Plan for the Caribbean Region of Colombia. Sigma. Project commissioned by the National Planning Department (DNP). Funded by the IDB.
2017. Director. Governance recommendations for the land use and hydrographic basins planning process to incorporate energy and mining activities. Commissioned by the Colombian Ministry of Energy and Mines to PORTEX. September-December 2017. Funded by the IDB.
2017. Identification of innovative business models in an infrastructure Colombian corporation (core business annual sales: USD 1 billion in 2016).
2017. Estimation of the macroeconomic impact of delays in infrastructure and electricity projects attributed to public red-tape procedures in Colombia. Fedesarrollo. Co-author with A. Martínez, D. Forero and L. Villar. Commissioned by a consortium of sector firms.
2017. Leader of the Spending Review for the public transport sector of Colombia. Fedesarrollo. Commissioned by the National Planning Board as a component of 4 sector reviews. Supported by the World Bank.
2017. Assessing the benefits and costs of switching to natural gas in public transport in Colombia. Co-Director of a consulting project developed by Steer Davies and Gleave for a natural gas company.
2017. Editorial support to the "Flagship Report: Energy Markets in Latin America and the Caribbean – Emerging Disruptions and the Next Frontier" of the World Bank.
2016. Coordinator of the the Master Multimodal Transport Plan 2 of Colombia. Fedesarrollo. Commissioned by Financiera de Desarrollo Nacional (FDN).
2016. Coordinator of the Transport Master Plan for the Central Region of Colombia (RAPE). Fedesarrollo. In association with Steer Davies Gleave.
- Second semester of 2016. Discussion of the regulatory proposal to remunerate transport pipelines

(WACC) in Colombia. Document commissioned by Naturgas (Association of natural gas regulated firms).

Second semester of 2015. Competition in mobile telecommunications in Colombia; and spectrum design proposal for the 700 Mhz band. Fedesarrollo. With Felipe Castro.

2015. Technical Manager of the Master Multimodal Transport Plan 1 of Colombia. Fedesarrollo. Commissioned by Financiera de Desarrollo Nacional (FDN).

Second semester of 2014 and First semester of 2015. Derivex (financial hedging in electricity markets company). Impact of electricity auctions on price, subsidies and competitiveness in Colombia.

Second semester of 2013. Institutional and actor analysis for climate change policy making in Bogotá-Cundinamarca (for PRICC, funded by UNDP); Inputs for the National Mining Plan (for UPME; coordination of 16 diagnostic and recommendations papers); Inputs for Vive Digital 2 (for MINTIC, in collaboration with other Colombian universities and the MIT).

September 2011-March 2012. "Colombia. Road Concessions: Building Transparency." (In Spanish). Roberto Steiner, Juan Benavides, Armando Montenegro, Sergio Jaramillo, Alejandro Linares. Fedesarrollo. Funded by the Foreign and Commonwealth Affairs, UK Embassy in Colombia.

May 2011-December 2011. "Propuestas para la restructuración de la pequeña minería del carbón del interior de Colombia." Natalia Salazar, Pilar Cabrera, Juan Gonzalo Zapata, Juan Benavides, Lina Devis. Fedesarrollo. Funded by Ministerio de Minas y Energía.

April 2010-April 2011. National Planning Department of Colombia (DNP). "Policies for hydrocarbon transformation in Colombia." Angela Cadena, Juan Benavides, Juan Carlos Salazar, Martha Rodríguez, Christian Ketels (Harvard Business School).

August 2011-October 2011. NATURGAS (Colombian Association of Natural Gas Utilities). "Riesgo y remuneración de la distribución de gas natural en Colombia." Juan Benavides, Angela Cadena, Javier Serrano, Gabriel Vizcaíno. Uniandes.

January 2010-June 2010. "Asesoría y acompañamiento al Gobierno Nacional en el análisis de priorización de las estrategias de movilidad a implementar en la Región Capital Bogotá-Cundinamarca." Jorge Acevedo, Juan Pablo Bocarejo, Miguel Urrutia, Juan Benavides.

July 2009-October 2009. Colombian automotive assembly firms. Diagnosis and strategy formulation study (with Juan Carlos Echeverry).

July 2008-February 2009. Inter-American Development Bank. Cost-benefit analysis of the Pasto Mocoa road, for INVIAS (Instituto Nacional de Vías), Colombia.

April 2008-December 2008. NATURGAS. Calculation of the WACC for natural gas transport and distribution firms (with Javier Serrano, Francisco Azuero and Eric Rodríguez, Uniandes).

September 2007-April 2008. Corporación Andina de Fomento (CAF), for the Minister of Finance, Colombia. "Alternativas de adjudicación de de proyectos de concesión vial en Colombia."

June 2007-April 2008. US AID. Review and proposals for natural gas transport regulation reform in Colombia.

May 2007. Inter-American Development Bank. Identification of institutional strengthening issues and plan for ENERSA (Electricity Utility of Entre Ríos, Argentina).

April 2007-October 2007. ACOLGEN (Colombian Association of Electricity Generators). Comments and recommendations for the Descending Clock Auction (DCA) for Firm Energy Obligations in the Colombian Wholesale Electricity Market (with Shmuel Oren, U. of California –Berkeley, Angela Cadena (Uniandes) and Alfredo García , U. of Virginia).

April 2007-July 2007. ASOCODIS (Colombian Association of Electricity Distributors). Calculation of the WACC for regulated distribution utilities (with Javier Serrano, Francisco Azuero and Eric Rodríguez, Uniandes).

## **CONSULTANT EXPERIENCE PRIOR TO JOINING THE IDB**

### **Advisor**

August 1995-August 1997. Colombian Electricity and Gas Regulatory Commission (CREG).  
Contribution to implementation of the wholesale electricity market regulatory measures.  
Analysis of anti-competitive behavior, design of capacity payment, guidelines for coordination between gas and electricity dispatch, contracting and regional market integration.

### **Expert Witness**

October-November 1999. The Colombian Nation vs. A Cellular Telephony Operator. Calculation of residual asset values of a cellular telephony BOT concession.

### **Reform Analysis and Design**

January 2000-July 2000. Office of the Mayor. City of Bogotá. Institutional Mission: Redesign of the City Institutions in Infrastructure Services (Transportation, Housing, Civil Works).

August 1998-August 1999. Consultant for the Inter-American Development Bank. Analysis of six infrastructure conflicts in Colombia to assess the scope of renegotiation of private participation (three in electricity markets, two highway franchises, one in cellular telephony).  
With Israel Fainboim.

### **Energy Markets and Regulation**

July-September 1999. CREG. Design of an incentive compatible mechanism for quality regulation in electricity distribution networks.

June-July 1999. Planning Unit of the Ministry of Energy and Mines (UPME), Colombia. Impacts on Competition and Entry in the Wholesale Electricity Market due to selling the San Carlos hydroelectric plant.

January-May 1999. Chivor, S. A (Power generator). Economic Analysis of the Colombian Spot Electricity Market.

December 1998-January 1999. UPME. Workshop on regulation of electric transmission and review of the auctioning scheme of new link additions.

November 1998-January 1999. Booz Allen & Hamilton. Strategy for Power Generation Development Using Natural Gas from the Camisea Project. Republic of Perú.

February-March 1998. Booz Allen & Hamilton and K&M. Specification of the settlement mechanism for bilateral contracts in the Ecuadorian Spot Electricity Market (with Don Hertzmark). Republic of Ecuador.

October 1997. Booz Allen & Hamilton. Review of capacity requirements in the Colombian generation market.

October 1997. Econometría Ltda. Regulation and privatization of generation assets (for Banco Bilbao Vizcaya, Spain).

October 1997. Empresas Públicas de Medellín. Assessment of the electricity regulatory reform and its impact on asset values (with Pablo Spiller, U. of California, Berkeley and LECG).

April 1997. National Planning Board (DNP). Infrastructure Division. Energy Infrastructure and Economic Growth.

Fall 1993- Fall 1995. National Science Foundation. Project: Optimal Recovery and Reconstruction of Lifelines after Major Earthquakes. Multidisciplinary Center for Earthquake Engineering Research (MCEER). Co-principal investigator (with Adam Rose). Penn State University.

### **Telecommunications and Water Regulation and Strategy**

May 2000-July 2000. TELECOM (Colombia). Calculation of infrastructure fees to be charged to publicly owned TV channels.

April 2000-June 2000. TV Channels A and One franchisers. Development of a tariff scheme for TV time and implementation with the Colombian National Commission of Television.

December 1998-September 1999. Design of a negotiation strategy for network interconnection in

telecommunications for a long distance operator in Colombia (with Bridger Mitchell (Charles River Associates) and Glenn Woroch (U. of California, Berkeley)).

November 1998-September 1999. Ministry of Telecommunications of Colombia and National Science Fund, COLCIENCIAS. Interconnection Policies and Universal Service Provision in Telecommunications.

February 1998-May 1998. Colombian Water and Sanitation Regulatory Commission (CRA). Compilation of regulatory literature on water and sanitation.

September 1997. Ministry of Telecommunications, Colombia. Computation of the access fee for new long-distance operators (with I. Fainboim).

June 1997. Colombian National Commission of Television. Revision of the franchise value of the two National TV channels through the income elasticity of net marketing investment (with J. Leibovich).

### **Risk Modeling, Fiscal Policy and Private Finance**

April 2000-July 2000. CORREVAL (Investment Bank), Bogotá. Computation of contingent liabilities of the City of Bogotá for the ALO (Avenida Longitudinal de Occidente) Highway Project.

November 1999-April 2000. Arthur Andersen and the Ministry of Finance (Colombia). Design of a Monte Carlo computational tool to assess the contingent liabilities of the Colombian government of seven infrastructure projects (two power plants, two highway concessions, two water works, and an airport concession).

August 1998. Electricidad de Caracas. Financial Valuation of Metroeste, Chiriquí and Nordeste distribution firms. Republic of Panama.

June-July 1998. Electricidad de Caracas and DecisionWare. Financial Valuation of Electrocosta and Electrocaribe distribution firms. Privatization process of CORELCA. Successful bid (US\$ 1 billion).

November-December 1994. Colombian Petroleum Company (ECOPETROL). Development of real options models (binomial lattices) for oil exploration and development decisions.

### **Environmental and Natural Resource Economics**

September 1999-June 2000. UPME and Tecnogerencia. Strategic Environmental Assessment - SEA- of the Colombian Energy Sector.

December 1997. Ministry of the Environment (Colombia). Biodiversity management and access rules to biodiverse areas.

October 1993-January 1994. The World Bank and the Global Environment Facility. Program for Measuring Incremental Costs for the Environment of the Global Environment Facility (GEF).

Summer Intern 1992. Sponsor: Resources for the Future (RFF), Washington D.C. Energy and Natural Resources Division. Project: Economic Development, Environmental Conditions and Policy Design in Central and Eastern Europe (led by Michael Toman).

### **TECHNICAL PUBLICATIONS**

García, H. and J. Benavides. 2019. The political economy of ambient air pollution reduction in Mexico City. Commissioned by the World Bank.

Rave, C, and J. Benavides. 2019. The political economy of ambient air pollution reduction in Medellín. Commissioned by the World Bank.

Benavides, J. and G. Elizondo. 2018. "Technology disruption in the energy sector - Emergence of Decentralized Energy Resource (DER) Markets." Concept Note. World Bank.

Benavides, J, Á. Cadena, J. J. González, C. Hidalgo and A. Piñeros. 2018. "Mercado eléctrico en Colombia: transición hacia una arquitectura descentralizada." Fedesarrollo. Available at: <https://www.repository.fedesarrollo.org.co/handle/11445/3673>

"Evolución del sector logístico y apoyo del BID en Panamá." 2018. Inputs for publication.



Interamerican Development Bank.

Cabralles, S., R. Bautista and J. Benavides. 2017. "A model to assess the impact of employment policy and subsidized domestic fuel prices on national oil companies." *Energy Economics* 68: 566-578. Available at:

<https://www.sciencedirect.com/science/article/pii/S0140988317303791>

"Costo económico de la inestabilidad y debilidad normativa en la gestión socio-ambiental de los proyectos en los sectores minero-energético, de infraestructura y de telecomunicaciones, en el marco del proyecto Norte Claro." Juan Benavides, Astrid Martínez, David Forero and Leonardo Villar. Fedesarrollo. Available at:

<http://www.repository.fedesarrollo.org.co/handle/11445/3477>

"Plan Maestro de Transporte Intermodal PMTI 2015-2035: Infraestructura para el comercio exterior, el desarrollo regional y la integración del territorio." Fedesarrollo. Compilation of 9 policy papers. General editor and author of 7 papers. Available at:

[http://www.pmti.gov.co/sites/default/files/Compilado%20Entregables%20FDS%20para%20PMTI\\_30\\_Nov\\_2015\\_Final.pdf](http://www.pmti.gov.co/sites/default/files/Compilado%20Entregables%20FDS%20para%20PMTI_30_Nov_2015_Final.pdf)

"La banda de 700 MHz en telecomunicaciones móviles: Implicaciones para la competencia, el bienestar y el diseño de la subasta en Colombia." 2015. Juan Benavides and Felipe Castro. Fedesarrollo. Available at:

[http://www.repository.fedesarrollo.org.co/bitstream/11445/2441/2/Repor\\_Noviembre\\_2015\\_Benavides\\_Castro.pdf](http://www.repository.fedesarrollo.org.co/bitstream/11445/2441/2/Repor_Noviembre_2015_Benavides_Castro.pdf)

"Actualización de estudio sobre la competencia en el mercado de telefonía móvil en Colombia." Felipe Castro and Juan Benavides. 2015. Fedesarrollo. Available at:

<http://www.repository.fedesarrollo.org.co/handle/11445/2459>

"Estudio de impacto socioeconómico para el proyecto de recuperación de la navegabilidad por el Río Magdalena." 2015. Felipe Castro, Helena García and Juan Benavides. Fedesarrollo. Available at:

<http://www.repository.fedesarrollo.org.co/handle/11445/2938>

*Insumos para el desarrollo del Plan Nacional de Ordenamiento Minero* (e-book). 2014. Juan Benavides (editor and author of one chapter). Bogotá, Colombia: Ediciones Uniandes. Funded by UPME. ISSN e-book: 978-958-774-026-4. Available at:

<http://cider.uniandes.edu.co/@Publicaciones/PublicacionesCoedicion/PlanOrdenamientoMinero.pdf>

"Foreign investment, institutional quality, public expenditure and venture capital funds in emerging market countries." 2014. Hernán Herrera, Jerry Haar and Juan Benavides. *Global Economy Journal* 14: 127-162. ISSN: 1524-5861. Available at:

<https://www.degruyter.com/view/j/gej.2014.14.issue-2/gej-2013-0068/gej-2013-0068.xml?format=INT>

"Foreign direct investment, institutional quality, economic freedom and entrepreneurship in developing markets." 2014. Hernán Herrera, Jerry Haar and Juan Benavides. *Journal of Business Research* 67: 1921-1932. ISSN: 0148-2963. Available at:

<https://pdfs.semanticscholar.org/129d/e7e62764113b796141d361fdced02d752a54.pdf>

"Do Institutional Quality, Economic Freedom and Entrepreneurship Impact Foreign Direct Investment in Emerging Markets?" 2013. Hernán Herrera, Jerry Haar and Juan Benavides. *Technology and Management for Development Center* (TMD) Working Paper (TMD-WP-57). University of Oxford. ISSN: 2045-5119. Available at:

<http://www.oxfordtmd.org/content/do-institutional-quality-economic-freedom-and-entrepreneurship-impact-foreign-direct>

"Alternativas metodológicas de valoración de activos afectos a los contratos de telefonía móvil

- celular y consecuencias económicas para el estado.” Commissioned by the Ministry of Information Technologies and Telecommunications. 2013.
- “Institutional and Political Frameworks of Environmental Licensing Processes.” 2013. Diana Arbeláez, Juan Benavides and Bárbara Oñate. Centre for Social Responsibility in Mining (CSRMI). The University of Queensland, Australia. Available at: <http://im4dc.org/wp-content/uploads/2013/09/Institutional-and-Political-Frameworks-of-Environmental-Licensing-Processes1.pdf>
- “Instituciones, investigación e innovación en Colombia.” 2013. Chapter 12 in Luis E. Orozco (compilador), *La educación superior: retos y perspectivas*. Bogotá, Colombia: Libros blancos de la Universidad de los Andes. Pp. 447-481. ISBN: 978-958-695-919-3.
- “Estrategia energética de Colombia en el contexto del cambio climático.” 2013. In Martha Cárdenas and Manuel Rodríguez (eds.) *Desarrollo económico y adaptación al cambio climático*. Bogotá, Colombia: Friedrich Ebert Stiftung in Colombia and Foro Nacional Ambiental. Pp. 189-214. ISBN: 978-958-8677-08-8. Available at: <http://library.fes.de/pdf-files/bueros/kolumbien/09895.pdf>
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## **FELLOWSHIPS AND GRANTS**

Recipient of Fulbright, Organization of American States, Encyclopaedia Britannica and



COLCIENCIAS fellowships to conduct doctoral studies.

**LANGUAGES**

Spanish (native) and English. French (passive).

**REFERENCES**

Available upon request.

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