

## **EDGAR VIRGÜEZ, Ph.D.**

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### **Education**

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#### **Duke University, Durham, North Carolina, United States**

##### **Ph.D. Environmental Sciences and Policy – January 2022**

Affiliation: Graduate School & Nicholas School of the Environment

Dissertation Title: An interdisciplinary assessment of alternatives for the decarbonization of the electric power sector: Integrating operations research and geospatial analysis to identify cost-efficient strategies for the energy transition

Committee: Dalia Patiño (Chair), Kate Konschnik, Lincoln Pratson, Patrick Halpin & Timothy Johnson

##### **M.A. Environment (Energy & Environment concentration) – July 2018**

Affiliation: Graduate School & Nicholas School of the Environment

Thesis Title: Utility-scale photovoltaics and storage: Decarbonizing and reducing greenhouse gases abatement costs

Committee: Dalia Patiño (Chair), Kate Konschnik (Co-chair), Lincoln Pratson, Patrick Halpin & Timothy Johnson

#### **Universidad de los Andes, Bogotá, Colombia**

##### **M.Sc. Environmental Engineering – December 2010**

Affiliation: Department of Civil and Environmental Engineering, School of Engineering

Thesis Title: Optimal allocation of societal resources into environmental mitigation strategies

Committee: Eduardo Behrentz, Felipe Muñoz & Mauricio Sánchez

##### **B.Sc. Environmental Engineering – May 2009**

Affiliation: Department of Civil and Environmental Engineering, School of Engineering

##### **B.Sc. Chemical Engineering – May 2009**

Affiliation: Department of Chemical Engineering, School of Engineering

Graduation Project Title: Coal-to-natural gas conversion of Bogota's industry as an essential component of the city's Air Quality Management Plan

### **Awards, Distinctions & Honors**

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This section contains a selected list of a) scholarships and fellowships, b) honors and professional awards, and c) institutional service distinctions. An extended description of each of the awards, distinctions, and honors that include the supporting organizations, and the total amount of the award, can be found at the "Professional Credentials" section of [my webpage](#)

#### **Scholarships and Fellowships**

**Total amount of scholarships and fellowships:** \$575,640

[S9]. Postdoctoral Research Fellow. Gates Venture. 2022-2023

- [S8]. Provost Fellow. Duke University Provost's Office. 2020-2021
- [S7]. Energy Transition Fellow. Energy Transition Institute. 2020
- [S6]. Energy Doctoral Student Fellow. Duke University Energy Initiative. 2019-2021
- [S5]. Bass Instructional Fellow: Digital Education Fellowship. Duke University Graduate School and Bass Endowment. 2019-2020
- [S4]. Energy Data Analytics Ph.D. Fellow. Alfred P. Sloan Foundation & Duke University Energy Initiative. 2018-2019
- [S3]. Nicholas School of the Environment Ph.D. Scholar. Duke University. 2016-2022
- [S2]. Rodolfo Llinas International Fellow. CEIBA Foundation. 2016-2020
- [S1]. School of Engineering Graduate Scholar. Universidad de los Andes. 2009-2010

### **Honors and Professional Awards**

**Total amount of professional awards:** \$26,425

- [H18]. Duke University's 2022 Commencement Student Speaker (finalist). Duke University. 2022
- [H17]. LatinX Awards: Excellence in Activism Award. Duke University's Center for Multicultural Affairs & Mi Gente. 2022
- [H16]. Best Student Paper Award. Energy and Environment Specialty Group, American Association of Geographers. 2022
- [H15]. Chron15: 15 leaders, pioneers, and icons at Duke University. Duke University Chronicle. 2021
- [H14]. Advancing Diversity and Inclusion Award. American Association of Geographers. 2021
- [H13]. International Awards Program: Graduate/Professional Academic Wizard of the Year. Duke University International House. 2021
- [H12]. Forever Duke Student Leadership Award. Duke University & Duke Alumni Association. 2021
- [H11]. Dean's Award for Excellence in Teaching. Duke University Graduate School. 2021
- [H10]. K. Patricia Cross Future Leader Award. Association of American Colleges and Universities (AAC&U). 2020
- [H9]. Graduate Students Charting the Course for the Future of the Academy. Beyond the Academy & University of California Los Angeles. 2020
- [H8]. Graduate School Professional Development Grant. Duke University Graduate School. 2019-2020
- [H7]. Third place (study case competition). Columbia University 13<sup>th</sup> Annual Energy Symposium. Columbia University & Booz Allen Hamilton. 2018
- [H6]. Electricity in Latin America and the Caribbean (ELAC) Working Group Grant. Center for Latin American and Caribbean Studies & Duke University Center for International and Global Studies. 2017-2018
- [H5]. People's Choice Award (study case competition). The Economist's Which M.B.A.? The Economist & N.R.G. Energy. 2017
- [H4]. Australia Awards International Fellow. Australia's Department of Economic Development, Jobs, Transport and Resources & Victoria State Government. 2015
- [H3]. Maximum Distinction for Graduate Studies. Universidad de los Andes. 2010
- [H2]. Procter & Gamble's Prestige Award. Procter & Gamble (P&G) Colombia. 2008
- [H1]. First place (Social Development Project Category) and best project presentation at the ExpoAndes study case competition. Universidad de los Andes. 2003

### **Institutional Service Distinctions**

- [I8]. Board Member (Young Trustee). Duke University Board of Trustees. 2022-2025
- [I7]. Senior Associate Dean for International Students Search Committee. Duke University's Vice Provost/Vice President of Student Affairs. 2021-2022
- [I6]. Racial Equity Advisory Council. Duke University President. 2021-2022

- [I5]. Board of Trustees Resources Committee. Duke University President and Duke University Board of Trustees. 2020-2021
- [I4]. Assistant Vice President for Student Affairs Search Committee. Duke University's Vice Provost/Vice President of Student Affairs. 2020
- [I3]. Executive Vice President Search Committee. Duke University. 2019-2020
- [I2]. Board of Trustees Resources Committee. Duke University President and Duke University Board of Trustees. 2019-2020
- [I1]. Board of Trustees Strategic Task Force: Activating the Global Network. Duke University President and Duke University Board of Trustees. 2018-2019

## **Professional, Research & Teaching Experience**

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The responsibilities and achievements for positions I held before 2015 are available on [my LinkedIn profile](#).

### **Professional and Research Positions**

01/2022-Currently      **Postdoctoral Research Scientist**  
Carnegie's Department of Global Ecology. Stanford University

#### **Responsibilities:**

Perform idealized modeling studies (e.g., macro-energy, integrated assessment, climate, and carbon-cycle modeling) to address climate and energy challenges. Lead projects resulting into research findings disseminated in high-impact and high-quality journals and scientific conferences. Work under the supervision of Ken Caldeira, Senior Scientist (emeritus) at Carnegie Institution for Science and Senior Scientist at Breakthrough Energy.

08/2016-01/2022      **Research Assistant**  
Nicholas School of the Environment. Duke University

#### **Responsibilities:**

Integrate methods from operations research and geospatial analysis to identify pathways toward sustainable power systems. Conceptualize and formulate analytical tools that support the transition to a deeply-decarbonized electric power sector.

#### **Achievements:**

- a. Programmed three analytical tools simulating: i) the production-cost process (day-ahead unit commitment and real-time economic dispatch models) to serve electricity demand of a service region including thermal generation assets, hydroelectric dams, and battery energy storage; ii) an availability and suitability analysis of utility-scale photovoltaic projects that account for zoning ordinances (including a user-friendly ArcGIS Pro siting tool); and iii) the geospatial and temporal evolution of generators' outages during ERCOT's energy crisis. Published research findings from their application in six journal papers and one conference proceeding.
- b. Awarded scholarships for more than \$250,000 (external resources) to complement the internal scholarship received by the Nicholas School of the Environment. Designated as a Rodolfo Llinas Scholar, an Energy Data Analytics Fellow, an Energy Doctoral Student Fellow, a Bass Instructional Fellow, and a Provost Fellow.
- c. Selected as a board member (Young Trustee) of Duke University's highest governing body, the Board of Trustees. Recognized as an individual of outstanding character, ability, and vision from the current ~10,000 graduate and professional student body and ~8,000 graduate or professional alums of Duke's Class of 2021 and 2022. Identified as an emerging leader with the qualities necessary to act as a university fiduciary responsible for procuring Duke's long-term health, overseeing and aligning its strategic direction, educational policy, finances and operations with its mission.

- d. Served in multiple leadership positions at the school level (e.g., Nicholas School Ph.D. Advocacy Council Co-President serving ~7% of all Duke Ph.D. Students) and institutional level (e.g., Board of Trustees Resources Committee), promoting the enhancement of the educational experience at Duke. Appointed to the search committee for three senior positions at the central administration, including the search committee for the Executive Vice President (Duke University's Chief Administrative and Financial Officer).
- e. Mentored undergraduate and graduate students who self-identified as members of minority groups (e.g., Latinos) and early-career practitioners in the energy and environment field. Designed a guide to establish or refine a structure to support peer-to-peer mentoring for doctoral students at Duke. Received multiple nominations (~27) for Duke's highest mentoring award for graduate students (Graduate School Dean's Award for Excellence in Mentoring).
- f. Promoted an increased interaction between domestic and international students, founding member of the Nicholas School Global Connections Initiative. Proposed and accompanied the design and implementation of a collaborative agreement between Fundación para el Futuro de Colombia (COLFUTURO) and the Nicholas School of the Environment to foster the cooperation through the provision of resources for Colombian graduate students (being this just the second school-specific agreement with a Latin American country).
- g. Represented the university at two national study-case energy competitions, achieving a 100% success rate by winning a top prize in both participations.

01/2016-07/2016

**Head of Research Cooperation**

Vice Presidency for Academic Affairs. Universidad de los Andes

**Responsibilities:**

Define, plan and execute activities to develop strategic alliances enhancing the university's global research vision.

**Achievements:**

- a. Accompanied and structured the formulation of the institutional internationalization strategy for the newly created Office of International Affairs.
- b. Established collaboration schemes with internationally recognized research institutions as follows:
  - Biosocial Complexity, Sustainability and Mathematical Science Center in partnership with Arizona State University (United States).
  - Center of Excellence in Sustainable Mining in partnership with the University of Queensland (Australia).
  - Research grants program in nanotechnology and biotechnology in partnership with Instituto Tecnológico y de Estudios Superiores de Monterrey (Mexico).
  - Research grants program in support of projects with German and Colombian researchers in partnership with the German Research Foundation - D.F.G. (Germany).
  - Tandem research groups in computational biology in partnership with Max Planck Institute (Germany).

06/2015-12/2015

**Head of Internationalization**

Vice Presidency for Research. Universidad de los Andes

**Responsibilities:**

Define, plan and execute international activities supporting the development of the university's research. Enable resources for research programs by establishing cooperation agreements and definition of collaboration networks. Direct the Summer Undergraduate Research Fellowship (SURF) Program with North American Universities.

**Achievements:**

- a. Conceptualized collaboration mechanisms with Purdue University designing a framework that would consolidate the institutional relationship.

- b. Adhered seven allied institutions to the SURF program: Arizona State University, California Institute of Technology, Dartmouth College, Massachusetts Institute of Technology, Purdue University, Rice University, and the University of Colorado at Boulder.
- c. Designed a standard operating procedure for the postulation, selection, and preparation of beneficiaries in the SURF program, including a training symposium to enhance research skills.
- d. Diversified the number of external sources supporting the SURF program generating a 400% increase in external funding (\$107,000).
- e. Widened the impact of the SURF program by generating a 65% increase in the number of beneficiaries of the program without increasing the internal funding.

06/2012-05/2015

**Department Coordinator**

Department of Civil and Environmental Engineering. Universidad de los Andes

**Responsibilities:**

Administer academic and financial processes for undergraduate (Civil Engineering & Environmental Engineering), master (MSc. Civil Engineering & MSc. Environmental Engineering), and doctoral programs of the Civil and Environmental Engineering Department comprising 1,800 students (10% of the total university student body).

**Achievements:**

- a. Optimized the Income Distribution Model from the Central Administration, augmenting the Department's revenue by two million dollars (\$2,000,000) and achieving a 99% efficiency during the 2012-2015 period (10% increase).
- b. Developed and implemented a standard operating procedure for the academic and administrative processes in the Department.
- c. Constructed reports, KPIs, and agendas supporting the National Quality Accreditation of three programs: Master for Civil Engineering, Bachelor in Science in Civil Engineering, and Bachelor in Science in Environmental Engineering. The three programs gained accreditation for periods exceeding national averages.
- d. Conceptualized and defined the Departmental Strategic Plan for Faculty Recruitment for 2015-2020.
- e. Designed a double-degree agreement with Universidad Catolica de Chile for the Master Programs.

01/2012-05/2015

**Professional Research Assistant**

Urban and Regional Sustainability Research Group. Department of Civil and Environmental Engineering. Universidad de los Andes

10/2013-01/2014

**Consultant**

Interamerican Development Bank (IDB)

12/2010-11/2011

**Consultant Engineer**

Multivac Consultores

05/2010-08/2010

**Academic Guest**

Department of Civil, Environmental and Geomatic Engineering. Swiss Federal Institute of Technology Zurich (ETH)

05/2010-07/2010

**Professional Research Assistant**

Department of Civil and Environmental Engineering. Universidad de los Andes

08/2010-01/2011

**Graduate Research Assistant**

- 08/2009-04/2010      Urban and Regional Sustainability Research Group. Department of Civil and Environmental Engineering. Universidad de los Andes
- 08/2008-08/2009      **Research Assistant**  
Urban and Regional Sustainability Research Group. Department of Civil and Environmental Engineering. Universidad de los Andes
- 12/2007-01/2008      **Project Researcher**  
Environmental Engineering Research Group. Department of Civil and Environmental Engineering. Universidad de los Andes
- 06/2007-12/2007      **Intern**  
Environmental Engineering Research Group. Department of Civil and Environmental Engineering. Universidad de los Andes

### **Teaching Positions**

- 01/2017-12/2020      **Instructor of the Record**  
Nicholas School of the Environment & Trinity College of Arts and Sciences.  
Duke University

**Course:** Voices in the Environment (2017, 2018, 2019, 2020)

**Achievements:**

- a. Redesigned a course to introduce two pedagogical strategies for achieving vibrant inclusiveness in classroom settings with diverse student populations: a) enabling engagement through authentic assessments and b) introducing global learning that draws on students' cultural heritage (service-learning components). Following positive student reception after the course redesign, the university launched new course sections in three additional languages (i.e., Chinese, French, and German).
- b. Published recommendations from the course redesign in two book chapters that provide practical pedagogical tips for graduate students and analyze the role of language and culture in the broader discussion of education for sustainability.
- c. Rated as one of the best teachers (top 5%) in undergraduate programs at Duke in Fall 2020 (4.57/5.00 instructor rate). Recognized as a next-generation instructor exemplifying the characteristics of effective college teaching impacting the experience of undergrad and graduate students, receiving awards for contributions to teaching and higher education: Duke's most distinguished teaching award for graduate students, the Graduate School Dean's Award for Excellence in Teaching, and the prestigious K. Patricia Cross Future Leader Award by the Association of American Colleges and Universities (AAC&U).
- d. Advocated for projects supporting an enhanced experience for underrepresented groups (e.g., first-generation students), promoting inclusive pedagogical practices. Authored a university-wide resolution adopted by the Graduate and Professional Student Council to remove the GRE as a mandatory admission requirement. Co-sponsored the addition of a new bylaw to prevent hate and bias actions in the student body.

- 01/2012-05/2016      **Lecturer**  
Department of Civil and Environmental Engineering  
Universidad de los Andes

**Courses:** Environmental Thermochemistry (2014-2016), Solid Mechanics (2012-2016), Graduate Project Seminar (2012-2015), Undergraduate Project (2012-2015), and Thesis Seminar (Master Studies) (2012-2015).

**Achievements:**

- a. Rated as one of the best professors of the Civil and Environmental Engineering Department, obtaining an average score of 92/100 in student polls (2012-2016 period), serving on average 45 students per course. Scores obtained through all periods were consistently higher than the Department and the School of Engineering average.
- b. Redesigned the courses comprising the graduation project cycle in undergraduate programs and thesis cycle in master programs, including new modules for enhancing transferable skills and using advanced tools in bibliographic databases (e.g., I.S.I. Web of Science).

01/2011-06/2011      **Lecturer**  
 Politecnico Grancolombiano  
**Course:** Environmental Culture.

08/2005-05/2010      **Teacher Assistant**  
 School of Engineering. Universidad de los Andes  
**Courses:** Industrial Process Stoichiometry (2005), Industrial Processes Fundamentals (2007), Pollution Prevention (2008), Environmental Modeling (2010), and Mathematical Models in Biology (2010).

## **Publications & Presentations**

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This section contains a list of publications classified as a) book and book chapters, b) journal papers, c) conference proceedings, and d) professional development blogs and op-eds. Additionally, it includes a selected list of oral presentations and poster presentations.

The following list describes the number of items included in each section and a hyperlink for easy navigation.

<a href="#">Journal papers (published or in-press):</a>	10
<a href="#">Journal papers (submitted &amp; under review):</a>	3
<a href="#">Journal papers (in preparation):</a>	4
<a href="#">Conference proceedings:</a>	5
<a href="#">Book chapters:</a>	2
<a href="#">Books:</a>	1
<a href="#">Feature articles, op-eds and columns:</a>	9
<a href="#">Selected oral presentations:</a>	20
<a href="#">Selected poster participations:</a>	4

Each item is listed using the most recent American Psychological Association (A.P.A.) citation style.

### **Journal Papers**

#### **a. Published or in press**

Impact factors from Clarivate’s Journal Citation Report (J.C.R.) for the paper’s year. For articles published this year where J.C.R. results are not available, the impact factor corresponds to the previous year.

Average impact factor of journals at the time of publication:      5.92

**[P10].** Wang, X., Virguez, E., Mei, Y., Yao, H., & Patino-Echeverri, D. (2022). Integrating wind and photovoltaic power with dual hydro-reservoir systems. *Energy Conversion and Management*, 257,

- 115425 (Research Paper – I.S.I. & Scopus Register; ISSN: 0196-8904). Impact Factor: 9.71. <https://doi.org/10.1016/j.enconman.2022.115425>
- [P9]. Li, M., Shan, R., Virguez, E., Patino-Echeverri, D., Gao, S., & Ma, H. (2021). Energy storage reduces costs and emissions even without large penetration of renewable energy: the case of China's Southern Power Grid. *Energy Policy*, 112711. (Research Paper – I.S.I. & Scopus Register; ISSN: 0301-4215). Impact Factor: 6.14. <https://doi.org/10.1016/j.enpol.2021.112711>
- [P8]. Li, M., Virguez, E., Shan, R., Tian, J., Gao, S., & Patino-Echeverri, D. (2021) High-resolution data shows China's wind and solar energy resources are enough to support a 2050 decarbonized electricity system. *Applied Energy*, 306, Part A, 117796. (Research Paper – I.S.I. & Scopus Register; ISSN: 0306-2619). Impact Factor: 9.75. <https://doi.org/10.1016/j.apenergy.2021.117796>
- [P7]. Sykora-Bodie, S., Jones, L., Hastings, Z., Barnett, M., Davis, O., Ferrari, O., Garcia, V., Hofner, A., Hunter, B., Ippolito, T., Krantz, W., Lombardi, E., Neyra, O., Perez-Figueroa, O., Raub, K., Sou, J., Virguez, E., Waters, T., & Whitten, J. (2021). Graduate student perspectives on transforming academia. *Conservation Science and Practice*, 556. (Perspective Paper – I.S.I. & Scopus Register; ISSN: 2578-4854). Impact Factor: 3.23. <http://doi.org/10.1111/csp2.556>
- [P6]. Virguez, E., Wang, X., & Patiño-Echeverri, D. (2021). Utility-scale photovoltaics and storage: Decarbonizing and reducing greenhouse gases abatement costs. *Applied Energy*, 282, 116120. (Research Paper – I.S.I. & Scopus Register; ISSN: 0306-2619). Impact Factor: 9.75. <https://doi.org/10.1016/j.apenergy.2020.116120>
- [P5]. Wang, X., Virguez, E., Xiao, W., Mei, Y., Patino-Echeverri, D., & Wang, H. (2019). Clustering and dispatching hydro, wind and photovoltaic power resources with a multiobjective optimization of power generation fluctuations: a case study in southwestern China. *Energy*, 189, 116250. (Research Paper – I.S.I. & Scopus Register; ISSN: 0360-5442). Impact Factor: 6.08. <https://doi.org/10.1016/j.energy.2019.116250>
- [P4]. Wang, X., Virguez, E., Chen, L., Duan, K., Dong, Q., Ma, H., Mei, Y., & Wang, H. (2019). New index for runoff variability analysis in rainfall-driven rivers in the southeastern United States. *Journal of Hydrologic Engineering*, 24 (12). (Research Paper – I.S.I. & Scopus Register; ISSN: 1943-5584). Impact Factor: 1.59. [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0001826](https://doi.org/10.1061/(ASCE)HE.1943-5584.0001826)
- [P3]. Wang, X., Virguez, E., Kern, J., Chen, L., Mei, Y., Patino-Echeverri, D., & Wang, H. (2019). Integrating wind, photovoltaic, and large hydropower during the reservoir refill period. *Energy Conversion and Management*, 198, 11178. (Research Paper – I.S.I. & Scopus Register; ISSN: 0196-8904). Impact Factor: 8.21. <https://doi.org/10.1016/j.enconman.2019.111778>
- [P2]. Rodriguez, R., Virguez, E., Rodriguez, P., & Behrentz, E. (2016). Influence of driving patterns on vehicle emissions: a case study for Latin American cities. *Transportation Research Part D*, Volume 43, pp. 192-206 (Research Paper – I.S.I. & Scopus Register; ISSN: 1361-9209). Impact Factor: 2.34. <https://doi.org/10.1016/j.trd.2015.12.008>
- [P1]. Fischer, K., Virguez, E., Sánchez-Silva, M., & Faber, M.H. (2013). On the assessment of marginal life-saving costs for risk acceptance criteria. *Structural Safety*, 44, pp. 37-46 (Research Paper – I.S.I. & Scopus Register; ISSN: 0167-4730). Impact Factor: 2.39. <https://doi.org/10.1016/j.strusafe.2013.05.001>

## b. Submitted or in preparation



- [PS3]. Dioha, M., Lukuyu, J., Virguez, E., & Caldeira, K. Guiding the deployment of electric vehicles in the developing world. **Submitted to *Environmental Research Letters*** (Under review).
- [PS2]. Virguez, E., Wang, X., Johnson, T., Fay, J., & Patino-Echeverri, D. Assessing the effect of incorporating land-use parcel-level data and local zoning ordinances when quantifying renewable energy resources potential. **Submitted to *Joule*** (Under review).
- [PS1]. Wang, Y., Wang, X., Virguez, E., Hu, T., Mei, Y., & Wang, H. Effect of hourly re-regulation on flow regime alteration of the Three Gorges Dam and Gezhouba Dam hydro junction. **Submitted to *Water*** (Review and resubmit – first round of revision).
- [PP4]. Virguez, E., Wang, X., & Patino-Echeverri, D. Low-temperature induced failures in unwinterized wind power plants: Assessing the benefits of a continued operation under extreme weather. **Intended Journal:** Renewable Energy (In preparation).
- [PP3]. Virguez, E., Antonini, E., Duan, L., Ruggles, T., Davies, S. & Caldeira, K. (2022). Storage requirements as a metric of global geographic variability of wind and solar resources. **Intended Journal:** Nature Energy (In preparation).
- [PP2]. Keeler, B., Locke, C., Bennett, E., Gerber, L., Grimm, N., Guerry, A., Hellmann, H., King, E., Mason, S., Nibbelink, N., Olander, O., Ricketts, T., Rowell, K., Schively, C., Secord, D., Sykora-Bodie, S., Ticktin, T., Vira, B., & Virguez, E. Reforming academic structures to promote engaged scholarship: Scaling bright spots to systemic change. **Intended Journal:** Nature Sustainability (In preparation).
- [PP1]. Virguez, E., Espinosa, M., Castillo, J., Patino-Echeverri, D. & Behrentz, E. The price of inaction: Estimating health and economic consequences of derogating Bogota's Air Quality Management Plan. **Intended Journal:** Sustainable Development (In preparation).

### **Conference Proceedings (indexed and peer-reviewed)**

- [C5]. Antonini, E., Virguez, E., Ruggles, T., Ashfaq, S., Duan, L., & Caldeira, K. (2022). Wind resources over the North Sea: Characterizing wind variability and droughts over 71 years. *Proceedings of the International Mechanical Engineering Congress & Exposition (IMECE) 2022 Conference*. **Under review.**
- [C4]. Virguez, E. & Patiño, E. (2019). Abating carbon emissions by means of utility-scale photovoltaics and storage: The Duke Energy Progress/Carolinas case study. *FISE-IEEE/CIGRE Conference*, pp. 1-6 (Conference Paper – I.S.I. & Scopus Register; ISBN: 978-172814230-2). <https://doi.org/10.1109/fiscigre48012.2019.8985012>
- [C3]. Valenzuela, M., Espinosa, M., Virguez, E., & Behrentz, E. (2017). Uncertainty of greenhouse gas emission models: a case in Colombia's transport sector. *Transportation Research Procedia*, Volume 25, pp. 4610-4626 (Conference Paper – I.S.I. & Scopus Register; ISSN: 2352-1465). <https://doi.org/10.1016/j.trpro.2017.05.380>
- [C2]. Faber, M.H., & Virguez-Rodríguez, E. (2011). Supporting decisions on global health and life safety investments. 2011., *Applications of Statistics and Probability in Civil Engineering - Proceedings of the 11<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering*, pp. 434-443 (Conference Paper – Scopus Register; ISBN: 978-0-415-66986-3). <https://doi.org/10.1201/b11332>

- [C1]. Fischer, K., Virguez-Rodríguez, E., Sánchez-Silva, M., & Faber, M.H. (2011). Defining guidelines for the application of the marginal life-saving costs principle for risk regulation. *Applications of Statistics and Probability in Civil Engineering - Proceedings of the 11<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering*, pp. 444-451 (Conference Paper –Scopus Register; ISBN: 978-0-415-66986-3). <https://doi.org/10.1201/b11332>

### Books and book chapters

- [BC2]. Reisinger, D., Liu, Y., Valnes, S., & Virguez, E. (2021). Sustainability across the curriculum: A multilingual and intercultural approach. In M. J. De la Fuente (Ed.). *Education for Sustainable Development in Foreign Language Learning: Content-Based Instruction in College Level Curricula* (pp 197-214). New York: Routledge Research in Language Education. ISBN: 978-0-36753-032-7. **Book Chapter.**
- [BC1]. Virguez, E. (2021). Embracing the value of cultural wealth from underrepresented groups. In K.L. Armstrong, L.A. Genova, J.W. Greenlee, & D.S. Samuel (Eds.). *Teaching Gradually: Practical Pedagogy and Classroom Strategies for Graduate Students by Graduate Students* (pp 190-196). Sterling, Virginia: Stylus Publishing L.L.C. ISBN: 978-1-64267-160-5. **Book Chapter.**
- [B1]. Behrentz, E., Benavides, J., Bocarejo, J., Canal, M., Espinosa, M., Rodríguez, R. ... Virguez, E. (2011). *Plan Decenal de Descontaminación del Aire para Bogotá*. Bogotá, Colombia: Secretaría Distrital de Ambiente. ISBN: 978-980-6810-45-7. **Book.**

### Feature Articles, Op-Eds, and Columns

- [D9]. Virgüez, E. Ten simple rules to succeed in graduate school being an international student. (In preparation)
- [D8]. Virgüez, E. Customizing your professional development journey to improve your scholarly integrity. (In preparation)
- [D7]. Virgüez, E. Expecting during the Ph.D.? Five recommendations from a first-time parent and graduate student. (In preparation)
- [D6]. Virgüez, E. The world is changing: As an early-career scholar, I need the academy to change with it. (Under review)
- [D5]. Virgüez, E. How I balanced my Ph.D. research with opening doors for others. *Science*. <https://doi.org/10.1126/science.abq8440>
- [D4]. Virgüez, E. (2022). Bring more early early-career scholars into the administrative fold. *Higher Ed Dive*. [Link](#).
- [D3]. Virguez, E., Stantial, N, & Zhang, Y. (2019). Understanding Duke Health Insurance: An Emerging Leaders Institute project. *Duke University's Graduate School Professional Development Blog*. [Link](#)
- [D2]. Virgüez, E. (2018). Enhancing my network of mentors. *Duke University's Graduate School Professional Development Blog*. [Link](#)

[D1]. Virgüez, E. (2018). Organizing your personal and professional OPTIONS. *Duke University's Graduate School Professional Development Blog*. [Link](#)

### Selected Oral Presentations

[O20]. Antonini, E., Virgüez, E., Ruggles, T., Ashfaq, S., Duan, L., & Caldeira, K. (2022). Wind resources over the North Sea: Characterizing wind variability and droughts over 71 years. *International Mechanical Engineering Congress & Exposition (IMECE) 2022*. Columbus, Ohio, United States. November.

[O19]. Virgüez, E. (2022). Building bridges over the ocean: Enabling sustainability education for marginalized communities in Latin America. *Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)*. San Juan, Puerto Rico. October.

[O18]. Virgüez, E., & Patino-Echeverri, D. (2022). Assessing the effect of incorporating land-use parcel-level data and local zoning ordinances when quantifying renewable energy resources potential, *American Association of Geographers Annual Meeting*. New York, New York, United States. February. **\*Recognized with the Best Student Paper Award by AAG's Energy and Environment Specialty Group.**

[O17]. Valnes, S., Liu, Y., Reisinger, D., & Virgüez, E. (2021). Language and culture for sustainability: Voices in the Environment., *ACTFL Annual Convention*. San Diego, California, United States. November.

[O16]. Virgüez, E. (2021). Who pays the price for our actions? The toll of the environmental problems for members of developing countries. *Duke Environmental Justice Symposium*. Durham, North Carolina, United States. March.

[O15]. Virgüez, E. (2020). Utility-scale photovoltaics and storage: Decarbonizing and reducing greenhouse gases abatement costs. *Energy Data Analytics Symposium: Transforming Energy Systems with Data Science Techniques*. Durham, North Carolina, United States. December.

[O14]. Virgüez, E. & Patiño-Echeverri, D. (2020). Enabling utility-scale photovoltaics integration via storage to abate carbon dioxide emissions., *Electric Power Conference*. Denver, Colorado, United States. April (canceled because of COVID-19 pandemic).

[O13]. Virgüez, E., Castillo, J., & Patiño-Echeverri, D. (2020). Estimating health and economic benefits of Bogota's air quality management plan., *North Carolina Conference on Latin American Studies (NC-CLAS)*. Charlotte, North Carolina, United States. March (canceled because of COVID-19 pandemic).

[O12]. Virgüez, E. (2020). Voices of changemakers: how commitments to learning, community, and equity shape future faculty (panelist), *Annual Meeting of the Association of American Colleges & Universities (AAC&U)*. Washington, D.C., United States. January.

[O11]. Virgüez, E. & Patiño-Echeverri, D. (2019). Abating carbon emissions by means of utility-scale photovoltaics and storage: The Duke Energy Progress/Carolinas case study, *FISE IEEE CIGRE Conference*. Medellin, Colombia. December.

[O10]. Virgüez, E. & Patiño-Echeverri, D. (2019). Utility-scale photovoltaics and storage: Economic and environmental trade-offs. *INFORMS Annual Meeting*. Seattle, United States. October.

- [O9]. Virgüez, E. & Patiño-Echeverri, D. (2019). Utility-scale photovoltaics plus storage: a cost-effective alternative for decarbonization? *Carnegie Mellon University Center for Climate and Energy Decision Making (CEDM) Annual Meeting*. Pittsburgh, Pennsylvania, United States. May.
- [O8]. Virgüez, E. (2019). Supporting utility-scale photovoltaics with storage: The Duke Energy Carolina and Duke Energy Progress case study. *Nicholas School of the Environment Annual Ph.D. Symposium*. Durham, North Carolina, United States. April.
- [O7]. Valenzuela, M., Espinosa, M., Virgüez, E. & Behrentz, E. (2016). Uncertainty of greenhouse gas emission models: Colombian transportation sector as a case of study., *14th World Conference on Transport Research*. Shanghai, China. July.
- [O6]. Amaya, R., Gutierrez, A., Muñoz, F. & Virgüez, E. (2014). Experience of Universidad de los Andes teaching process safety., *6th CCPS Latin American Conference on Process Safety*. Buenos Aires, Argentina. September.
- [O5]. Virgüez, E., Olaya, L. & Behrentz, E. (2013). Convenience of updating the emission standards for heavy-duty vehicles., *IV Congreso Colombiano y Conferencia Internacional de Calidad del Aire y Salud Pública*. Bogotá, Colombia. August.
- [O4]. Faber, M.H. & Virgüez-Rodríguez, E. (2012). Supporting decisions on global health and life safety investments., *L.Q.I. Symposium, Denmark Technical University*. Lyngby, Denmark. August.
- [O3]. Faber, M.H. & Virgüez-Rodríguez, E. (2011). Supporting decisions on global health and life safety investments. *11<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering*. Zurich, Switzerland. August.
- [O2]. Fischer, K., Virgüez-Rodríguez, E., Sánchez-Silva, M. & Faber, M.H. (2011). Defining guidelines for the application of the marginal life-saving costs principle for risk regulation. *11<sup>th</sup> International Conference on Applications of Statistics and Probability in Civil Engineering*. Zurich, Switzerland. August.
- [O1]. Behrentz, E. & Virgüez, E. (2011). Compressed natural gas on Colombia: study case for public transport vehicles., *XIV Congress of the Colombian Association of Natural Gas (Naturgas)*. Cartagena, Colombia. April.

### **Selected Posters Participations**

- [PO4]. Valenzuela, M., Espinosa, M., Virgüez, E., & Behrentz, E. (2015). Uncertainty of greenhouse gas emission models: Colombian transportation sector as a case study. *V International Congress of Air Quality and Public Health*. Bucaramanga, Colombia. August 12 – 14.
- [PO3]. Espinosa, M., Márquez, J.C.F., Orjuela, J.P., Virgüez, E., Sefair, J.A., Medaglia, A.L. & Behrentz, E. (2011). An optimization model for selecting and programming projects for Bogota's Air Quality Decennial Decontamination Plan. *III International Congress of Air Quality and Public Health*. Medellín, Colombia. November 30 – December 2.
- [PO2]. Virgüez, E. & Behrentz, E. (2011). Compressed natural gas on Colombia: study case for public transport vehicles. *III International Congress of Air Quality and Public Health*. Medellín, Colombia. November 30 – December 2.

[PO1]. Virguez, E., Obando, D.C., Muñoz, F., Sánchez, E.M. & Behrentz, E. (2009). Risk assessment of air pollution exposure using the Life Quality Index (L.Q.I.). *II International Congress of Air Quality and Public Health*. Cartagena, Colombia. July 14–17.

## Research & Consultancy Projects

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**Number of research or consultancy projects:** 19  
**Total budget of projects:** \$3,430,069

Each item lists the name of the project (underlined), role (bolded), supporting organizations (italics), and budget.

- 2018-2021 Designing a transformative strategy for the Colombian energy sector oriented to its reliability and social, economic, and environmental sustainability in the horizon of the year 2030. **Researcher.** *World Bank, Duke University, Colombian Higher Education Institutions, & Colombian Ministry of Education.* \$677,642.
- 2016-2017 Modelling Tools for Energy Systems Analysis (MOTESA), Bass Connections Project. **Researcher.** *Duke University.* \$25,000.
- 2016 Risk analysis in the treatment of polychlorinated biphenyl by chlorination. **Researcher.** *Colombian Ministry for Environmental Affairs and Sustainable Development.* \$28,500.
- 2015 Data-driven definition of Colombia's air quality policy roadmap. **Consultant.** *Korea Environment Corporation (KECO).* \$4,050.
- 2014-2015 Environmental and economic assessment of implementing compressed natural gas as the primary fuel for Bogota's public transport system. **Main Researcher.** *Colombian Association of Natural Gas (Naturgas). Universidad de los Andes.* \$32,500.
- 2013-2014 Demonstration and assessment of battery-electric buses for mass transit in Colombia. **Consultant.** *Interamerican Development Bank (IDB).* \$500,000.
- 2012-2013 Revision and adjustment of risk assessment models analyzing climatological and external events. **Coordinator.** *Empresa Colombiana de Petroleos (Ecopetrol) S.A. Universidad de los Andes.* \$425,670.
- 2012 Developing a cost-benefit study for updating normative emission standards of mobile sources. **Main Researcher.** *Colombian Ministry for Environmental Affairs and Sustainable Development & World Bank. Universidad de los Andes.* \$18,357.
- 2012 Infrastructure as the basis of production sectors: Analysis of critical points and vulnerabilities of the Colombian transport network affected by environmental disasters. **Researcher.** *Engineering School Research Center, Universidad de los Andes.* \$60,000.

- 2011 Identification of small and mid-size enterprises (SME) with the highest potential to implement an energy efficiency program. **Main Researcher.** *Corporación Ambiental Empresarial - Cámara de Comercio de Bogotá. Multivac Consultores.* \$4,000.
- 2011 Environmental and economic assessment of implementing compressed natural gas as the primary fuel for public transport vehicles. **Main Researcher.** *Colombian Association of Natural Gas (Naturgas).* Universidad de los Andes. \$10,000.
- 2010-2011 Economic feasibility study for the construction of a transfer station on Magdalena, Colombia, applying return of investment techniques. **Main Consultant.** *Sociedad de Acueducto, Alcantarillado y Aseo de Barranquilla S.A. - Fundación Reto Colombia. Multivac Consultores.* \$7,500.
- 2010-2011 Design of the environmental plan for the Integrated Resources District of Zárata-Malibú-Veladero swamp zone. **Researcher.** *Corporación Autónoma Regional del Magdalena (CORPAMAG) - Fundación Reto Colombia. Multivac Consultores.* \$190,000.
- 2010 Environmental impact assessment of Bogota's Integrated System for Public Transport. **Researcher.** *Bogota's Ministry of Finance, Inter-American Development Bank & Universidad de los Andes.* \$500,000.
- 2010 Risk management of infrastructure systems during natural events. **Researcher.** *Engineering Faculty Research Center, Universidad de los Andes.* \$25,000.
- 2008-2010 Formulation of Bogotá's Decennial Atmospheric Decontamination Plan. **Researcher.** *Bogota's Secretary for Environmental Affairs, Transmilenio S.A. & Universidad de los Andes.* \$325,000.
- 2008-2009 Development of Colombia's area sources classification guidelines and establishment of environmental control programs. **Researcher.** *Colombian Ministry for Environment, Housing, and Development, & Universidad de los Andes.* \$108,900.
- 2008-2009 Emissions assessment (isokinetic sampling) of fossil-fuel-fired stationary sources whose primary fuel is used oil. **Researcher.** *Colombian Ministry for Environment, Housing, and Development, & Universidad de los Andes.* \$37,950.
- 2007-2008 Definition of the technical elements used to formulate local standards to improve Bogota's air quality. **Researcher.** *Bogota's Secretary for Environmental Affairs & Universidad de los Andes.* \$450,000.

## **Professional Training, Affiliations & Skills**

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### **Certificates and Professional Programs**

**[CE5]. Certificate in college teaching – 2022**

**Institution:** Graduate School, Duke University

**Location:** Durham, North Carolina, United States

**[CE4]. Emerging leaders institute - 2019**

**Institution:** Graduate School, Duke University  
**Location:** Durham, North Carolina, United States

**[CE3]. Geospatial analysis certificate program – 2018**

**Institution:** Nicholas School of the Environment, Duke University  
**Location:** Durham, North Carolina, United States

**[CE2]. Applying research for sustainable and inclusive growth: linking universities, industry and government - 2015**

**Institution:** Department of Economic Development, Jobs, Transport and Resources, Australian Government  
**Location:** Melbourne, Australia

**[CE1]. Innovating with sense - 2015**

**Institution:** Proa Consulting  
**Location:** Bogota, Colombia

**Affiliation to Professional Associations**

- [PA8].** Air & Waste Management Association (A&WMA)
- [PA7].** American Association for the Advancement of Science (AAS)
- [PA6].** American Association of Geographers (AAG)
- [PA5].** American Geophysical Union (AGU)
- [PA4].** American Institute of Chemical Engineers (AIChE)
- [PA3].** Association of American Colleges & Universities (AAC&U)
- [PA2].** Institute for Operations Research and the Management Sciences (INFORMS)
- [PA1].** Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)

**Languages**

- [L3].** French (Beginner - A1)
- [L2].** English (Proficient – C1)
- [L1].** Spanish (Native speaker)

**Computational Skills**

**Languages:** C, C++, Optimization Programming Language (OPL), Python, Structured Query Language (SQL), & Visual Basic  
**Software:** ArcGIS, ArcGIS Pro, Aspen Plus, Crystal Ball, Homer, IBM ILOG CPLEX Optimization Studio, Matlab, & Microsoft Office Suite

**Institutional & Community Service**

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**Participation at Institutional Boards, Councils, and Committees**

- [IB20].** Young Trustee. Duke University Board of Trustees. Board Member (2022-2025)
- [IB19].** Carbon Offsets Advisory Board. Duke University. Member. (2021-2022)
- [IB18].** Graduate School Dean's Award for Excellence in Teaching Selection Committee. Duke University Graduate School. Member. (2021)

- [IB17]. Senior Associate Dean for International Students Search Committee. Duke University. Member. (2021-2022)
- [IB16]. Racial Equity Advisory Council, Duke University. Duke University. Member (2021-2022)
- [IB15]. Graduate and Professional Students' Housing Working Group, Duke University. Member (2021-2022)
- [IB14]. International Students Support Committee, Duke University. Member (2021-2022)
- [IB13]. Board of Trustees Resources Committee, Duke University. Member (2020-2021)
- [IB12]. Graduate and Professional Student Advisory Board. Duke University. Member (2020-2021)
- [IB11]. Executive Committee Reform Working Group. Graduate & Professional Student Council (GPSC). Member (2020)
- [IB10]. Duke University's Assistant Vice President for Student Affairs Search Committee. Duke University's Vice Provost/Vice President of Student Affairs. Member (2020)
- [IB9]. Duke University's Executive Vice President Search Committee, Duke University. Member (2019-2020)
- [IB8]. Board of Trustees Resources Committee, Duke University. Member (2019-2020)
- [IB7]. Duke Student Alumni Board, Duke Alumni Association. Member (2019-2020)
- [IB6]. Graduate & Professional Student Council (GPSC), Duke University. Ph.D. Environment Program Representative (2019-2021)
- [IB5]. Board of Trustees Strategic Task Force: Activating the Global Network, Duke University. Member (2018-2019)
- [IB4]. Graduate Student Affairs Advisory Committee (GSAAC), Duke University. Member (2018-2021)
- [IB3]. Nicholas School Doctoral Programs Advocacy Council (NPAC), Duke University. Co-President (2018-2021) & Treasurer (2017-2018)
- [IB2]. Nicholas School of the Environment Energy Club, Duke University. Doctoral Students Representative (2016-2019)
- [IB1]. Student Association for Geospatial Analysis, Duke University. Doctoral Students Representative (2017-2018)

### **Mentorship and Volunteering Activities**

- [M13]. Lumiere Education. Mentor (2020-2022)
- [M12]. Duke F1RSTS. Mentor (2018-2021)
- [M11]. Ekpa'palek Empowering Latinos. Mentor (2019-2020)
- [M10]. Nicholas School Global Connections Initiative. Academic Programs Leader (2017-2020)
- [M9]. Nicholas School Partners, Duke University. Co-President (2017-2019)
- [M8]. International House, Duke University. International House Orientation Peer (2017-2019)
- [M7]. Sustainable Duke, Duke University. Volunteer (2016-2018)
- [M6]. Duke Community Service, Duke University. Volunteer (2016-2018)
- [M5]. Habitat for Humanity Durham. Volunteer. (2016-2018)
- [M4]. Colombian Christian Church. Youth Leader Coordinator (2015-2016)
- [M3]. Un Techo para mi País. Volunteer (2009-2010)
- [M2]. Asociación Alianza Educativa, Universidad de los Andes. Instructor (2003-2007)
- [M1]. Colombian Red Cross. Junior Voluntary Member (1995-2002)



## References

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References are listed alphabetically using their last name and categorized into three categories: research, higher education, and teaching. Additional references are available at [my LinkedIn profile](#).

### Research

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