IDB
Inter-American
Development Bank

Attractors of Institutional Investment in Latin American Infrastructure

Lessons from Envision Project Case Studies

Andreas Georgoulias
Giovanni Leo Frisari
Hendrik Meller
María Cecilia Ramírez
Tomás Serebrisky
Graham Watkins

Climate Change and
Sustainability

TECHNICAL
NOTE Nº
IDB-TN-1386

May 2018

Attractors of Institutional Investment in Latin American Infrastructure

Lessons from Envision Project Case Studies

Tomás Serebrisky
Graham Watkins
Giovanni Leo Frisari
María Cecilia Ramírez
Hendrik Meller
Andreas Georgoulias

May 2018

Inter-American Development Bank

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library
Attractors of institutional investment in Latin American infrastructure: lessons from Envision project case studies / Tomás Serebrisky, Graham Watkins, María Cecilia Ramírez, Hendrik Meller, Andreas Georgoulias, Giovanni Leo Frisari.
p. cm. — (IDB Technical Note ; 1386)
Includes bibliographic references.
1. Infrastructure (Economics)-Latin America-Finance. 2. Infrastructure (Economics)-Caribbean Area-Finance. 3. Infrastructure (Economics)-Latin America-Planning. 4. Infrastructure (Economics)-Caribbean Area-Planning. 5. Infrastructure (Economics)-Environmental aspects-Latin America. 6. Infrastructure (Economics)-Environmental aspects-Caribbean Area. 7. Sustainable development-Latin America. 8. Sustainable development-Caribbean Area. I. Serebrisky, Tomás. II. Watkins, Graham. III. Ramírez, María Cecilia. IV. Meller, Hendrik. V. Georgoulias, Andreas. VI. Frisari, Giovanni Leo. VII. Inter-American Development Bank. Climate Change Division. VIII. Series.
IDB-TN-1386

bidcambioclima@iadb.org

www.iadb.org/climatechange

Abstract

This paper identifies the role, conditions for engagement, and contributions of institutional investors in infrastructure projects in the Latin American and Caribbean (LAC) region. Institutional investors are nonbank organizations that invest on behalf of their members, such as pension funds, mutual funds, endowments, and insurers. The paper is based on twelve case studies of specific infrastructure equity investments by institutional investors that have shown substantial sustainability performance, as measured by the Institute for Sustainable Infrastructure's Envision sustainability rating system. We follow a hybrid research approach, including both quantitative and qualitative data analysis components. The quantitative data analysis evaluates Envision project performance and scores, while the qualitative data analysis researches the conditions under which institutional investors were engaged in infrastructure projects.

Our analysis shows that institutional investors participated in projects mostly indirectly, through funds or shares in operators, as only two of the twelve projects with institutional investor participation had direct equity investments. Institutional investors engage directly in projects when a trusted local partner exists; in both cases with direct institutional investor participation, investors partnered with firms experienced in developing and operating infrastructure projects in the LAC region. Institutional investors owned the majority of the project in neither case, leaving responsibility for decision-making and operations capacity to the local partner. Most institutional investors entered projects in the operations phase. In the four cases where institutional investors were part of the project since early stages of development, investors participated indirectly by owning shares in the project company.

Institutional investors preferred countries that have taken extensive efforts to incentivize the participation of institutional investors in infrastructure projects, such as by easing quantitative portfolio limits for institutional investments in infrastructure and developing institutional infrastructure funds. Furthermore, institutional investors engaged in projects in the energy, transportation, and water and sanitation sectors, which have advanced and mature public-private partnership (PPP) markets. Most projects in these sectors offer predictable long-term returns through concessions (highways), Power Purchasing Agreements (all energy projects), and service agreements (wastewater utility).

Institutional investors chose projects with high performance on social sustainability and climate resiliency, comprehensively addressing aspects related to skills and capacity building, collaboration and stakeholder engagement, sustainability management systems, sustainable procurement, protecting freshwater resources, and assessing climate risks and short-term hazards. Notably, projects with direct institutional investor participation perform differently than projects with indirect participation. On average, projects with direct equity participation from an institutional investor performed slightly better in social and environmental sustainability aspects. Our analysis shows that continuous community engagement was a significant priority in projects with institutional investors, especially in the projects with direct institutional equity placements. All projects with institutional investors avoided natural ecosystems by choosing an alternative site or implemented comprehensive environmental management and monitoring initiatives to avoid disturbing critical ecosystems.

These aspects indicate some of the key project sustainability and country parameters that attract institutional investors' equity participation in infrastructure, which should be disseminated and addressed in infrastructure projects to incentivize greater institutional investor engagement in sustainable infrastructure investments in LAC.

JEL Codes: Q51, Q54, Q56
Keywords: sustainability, sustainable infrastructure, institutional investors, public private partnerships

Table of Contents

1. Introduction

Increasing access to reliable and sustainable infrastructure is regarded as a fundamental prerequisite for achieving the United Nations Sustainable Development Goals (SDGs) and inclusive, sustainable development in Latin America and the Caribbean (LAC). Yet, chronic underinvestment in infrastructure has created a major infrastructure gap in LAC, jeopardizing growth and productivity and exacerbating the impacts of climate change. The annual investment needs to close the infrastructure gap are estimated at $120-150 billion (Serebrisky et al., 2015). However, national governments are not able to cover the constantly increasing demand for infrastructure services through the conventional public financing model and are increasingly looking at alternative sources, including institutional investors, to finance infrastructure projects.

Institutional investors—nonbank organizations that invest on behalf of their members, such as pension funds, mutual funds, hedge funds, endowments, and insurers—are important players in the global financial market. Overall, total assets under management (AUM) of institutional investors in OECD countries were estimated at $92.6 trillion in 2013 (OECD, 2016a), while the annual inflow of new funds is growing rapidly. Due to the challenges posed to institutional investors by high market volatility and low interest rates globally, infrastructure is increasingly pursued as part of an alternative asset allocation. Infrastructure investments offer institutional investors stable returns over the long term, match their liabilities' timeframe, and help them diversify their portfolios.

However, institutional investors' participation in infrastructure projects remains limited. For example, a sample of 72 pension funds for 21 countries shows that from 2010 to 2013, on average they invested 5.4% of their portfolio in infrastructure, with ranges from 0% to 31% (Tuesta, 2015). Overall, the OECD large pension fund survey (2015) and Cerra et al. (2016) report that pension funds invest less than one percent of their assets in infrastructure, which include mostly operational (brownfield) projects.

2. Methodology of Analysis and Data Sampling

2.1 Goal

Our research focuses on identifying the role, conditions for engagement, and contributions of institutional investors in LAC infrastructure projects. The paper is based on case studies of specific infrastructure equity investments by large institutional investors, and addresses mobilization of private capital to incentivize investments in sustainable infrastructure.

The end goal of this paper is to identify the key project or country parameters that attract or prohibit institutional investors' equity participation in infrastructure projects, and as such point out the prevailing institutional gaps in LAC countries that need to be addressed in order to allow for greater institutional investors' engagement in sustainable infrastructure investments.

2.2 Approach

Our study identifies infrastructure projects in LAC that a) have shown substantial sustainability performance, as measured by the Institute for Sustainable Infrastructure's Envision sustainability rating system, and b) where institutional investors have been directly involved. We then research the conditions that determined investors' engagement in the said projects, emphasizing on relevant institutional arrangements needed for their specific engagement, in the context of sustainable investments.

The study draws conclusions by comparing, contrasting, and benchmarking its findings, clearly identifying and explaining the prevailing institutional gaps that need to be addressed in LAC countries to allow for greater institutional investors' engagement in sustainable infrastructure investments.

2.3 Research Questions

The study focuses on answering the following questions:

- What is the role and contribution of institutional investors in LAC infrastructure projects?
- How do they participate in projects?
- What are their conditions for engagement?
- Are there preferences for any infrastructure sector or host country?
- What are the prevailing institutional gaps that need to be addressed to incentivize their engagement in infrastructure?

2.4 Process of Analysis

Our research commenced with a review of the IDB Infrastructure 360 project database. Then we selected the projects with institutional investor equity participation. The Envision performance of projects with institutional investor participation was compared with the average project to identify

any trends or differences. We then further examined the key project and/or country drivers that attracted investment. Our conclusions discuss the key incentives for institutional investor engagement in infrastructure projects.

Our methodology can be summarized as follows:

I. Define institutional investor
II. Review current literature and latest industry benchmarks
III. Review Infra360 database
IV. Identify ownership structures
V. Single-out eligible projects
VI. Compare Envision performance & scores with average project
VII. Process and analyze findings
VIII. Draw conclusions and recommendations

2.5 Defining Institutional Investor

For the purpose of this paper, the institutional investor typology within the universe of investors and investment vehicles includes pension funds, insurance, mutual funds, and sovereign wealth funds. Furthermore, major private equity and hedge funds usually have institutional investors as shareholders. In this research, we also identify institutional investors that are local to the country of the project, are based in another LAC country, or come from another country excluding LAC.

2.6 Project Selection

For the selection of projects, the Infrastructure 360 Awards case studies from 2014, 2015, and 2016 applicants were assessed. This provides a pool of 39 projects, from which projects with institutional investor equity participation were singled out. Our analysis did not expand to debt financing, which may be the subject of future research. See Appendix B for a list of all the Infrastructure 360 projects and case studies.

2.7 Data Analysis

The paper follows a hybrid research approach, including both a quantitative and qualitative data analysis component. The quantitative data analysis focuses on evaluating Envision project performance and scores. This way, trends or commonalities between the singled-out projects are specified. Then, major differences with the average project are identified, highlighting Envision credits or categories. Finally, the paper evaluates whether projects with institutional investor participation over- or under- perform in Envision.

The qualitative data analysis component of the paper focuses on researching the conditions under which institutional investors were engaged in infrastructure projects. Qualitative findings from the review of the finalist case studies are examined to specify specific project conditions or

parameters that attract institutional investors. Then, a qualitative analysis of the new information from the case study research is conducted.

Findings discuss the common parameters of projects with institutional investor participation. The types of projects or countries that institutional investors were most likely to invest are identified, as well as the types of projects and countries in which no institutional investor participation was observed. Then, the key incentives for institutional investor engagement in infrastructure projects are discussed. The section concludes with the necessary changes that will unlock larger institutional investor participation in infrastructure projects in the LAC region.

2.8 Limitations of Research

It is important to note some of the limitations of this research. First, the research focuses only on available projects in the Infrastructure 360 database. This is a relatively small sample of 39 projects to begin with. Furthermore, only the projects in the Infrastructure 360 database that have had institutional investor equity participation are studied. Our research did not examine debt or bond financing, with the latter being a potential pathway of institutional investor participation in projects.

Since the research sample is not random and the sample size relatively small, statistical validity claims should not be drawn out of this work. However, findings from this work elucidate a grounded research approach that can provide significant insights. Furthermore, given that institutional investor participation in infrastructure is very small, studying existing projects with institutional investor participation may not uncover all the reasons that prohibit investment a) in infrastructure projects and b) specifically in infrastructure projects in the LAC region.

3. Infrastructure Projects with Institutional Investor Participation

3.1 Summary of Selected Projects

Our research on the Infrastructure 360 project database revealed twelve infrastructure projects with institutional investor participation. This section of the paper includes brief descriptions of each project; for more details on each, refer to Appendix C.

These projects range from highways to wastewater treatment plants, were built between 2013 and 2017, and have an average budget of $1.53 billion. Two projects are located in Mexico, two in Chile, three in Peru, three in Brazil, one in Colombia, and one in Ecuador.

Institutional investors participated in the projects in three different ways. In two projects, institutional investors directly own equity in projects. In five projects, institutional investors participated through funds, and in the remaining five projects, institutional investors own shares in the sponsor company that develops the project. Four of these investments are in greenfield projects (projects under development), and eight in brownfield (operational) projects.

The two projects with direct equity participation from an institutional investor were both in Mexico: Autopista Mayab and the Dominica wind farm. The **Autopista Mayab** is a 250 km highway, operated as a 25-year concession by the Consorcio del Mayab. Since 2015, ICA, a Mexican infrastructure firm that developed the project, has owned 51%, and the remaining 49% is owned by the Canadian institutional investor Caisse de Dépôt et Placement du Québec (CDPQ), which manages $286 billion.[1] The total investment is $423 million.

The **Dominica wind farm** is a 200 MW wind farm in Mexico, completed in 2015 for $346 million. The sponsor is Dominica Energia Limpia, a subsidiary of Enel Green Power México. CDPQ along with CKD IM Infraestructura México, a consortium of Mexican institutional investors, bought 70% of the project in October 2017. Dominica Energia Limpia remained responsible for operating the project.

The five projects with indirect institutional investor participation through funds were Planta de Concentración Solar Cerro Dominador, the Moquegua solar photovoltaic (PV) plant, the Pozo Almonte and Calama solar PV plant, and Vías Nuevas de Lima. **Planta de Concentración Solar Cerro Dominador** is a 210MW, $1.4 billion concentrated solar-thermal plant currently under construction[2] in Chile. The sponsor is EIG Global Energy Partners, which bought 100% of the project from Abengoa, a Spanish renewable energy firm, in 2015. Abengoa is responsible for construction and operations.

The **Moquegua solar PV plant** in Peru has a 16 MW capacity, cost $42.8 million to build, and is operated as a 25-year concession by Moquegua FV S.A.C., a subsidiary of Solarpack of Spain. Ardian Infrastructure bought 81% of project shares in 2016, but Solarpack remained as the project operator. The **Pozo Almonte and Calama solar PV plant** in Chile has a capacity of 26.5 MW and was built in 2014 for $80 million. The Spanish company Solarpack developed,

[1] https://www.cdpq.com/en/about-us.

[2] The first 62MW solar PV component of the plant was completed and connected to the Chilean grid in 2017. The solar-thermal component of the project is expected to be completed by 2019.

built, and operates the project. Ardian Infrastructure bought 81% of the project's shares in 2016. Solarpack remained responsible for operating the project.

The **Vías Nuevas de Lima** in Peru is a 30-year urban highway concession granted in 2013 at a cost of $590 million. Consorcio Líneas Viales de Lima (Odebrecht Investimentos and Constructora Norberto Odebrecht S.A., both from Brazil) is the project sponsor. Brookfield Asset Management, a Canadian alternative asset manager with $265 billion of AUM[3], bought 70% of the project's shares in 2015.

The five projects with indirect institutional investor participation through operator shares were the multipurpose north terminal at the port of Callao, the Tunjita hydropower plant, the Aquapolo water sanitation project, the Santo Antônio do Jari (Jari) hydropower plant, and the Mariscal Sucre international airport. The **multipurpose north terminal at the port of Callao** in Peru is a 30-year concession granted in 2011 to APM Terminals, a division of the Danish A.P. Moller Maersk group. Multiple institutional investors, such as Norway's government pension fund, own shares in the Maersk group. The project will cost $750 million.

The **Santo Antônio hydropower plant** in Brazil has a 3,566 MW capacity and began operations in 2012 at a total cost of $19 billion. The operating company, Santo Antônio Energia, controls the 35-year concession. Centrais Electricas Brasileiras (Electrobras) owns the majority of the project shares (39%) through Furnas Centrais Elétricas. Institutional investors own shares in Electrobras, including Macquarie, the Vanguard Group, and Harel Insurance.

The **Tunjita hydropower plant** in Colombia has a capacity of 19.8 MW, cost $67 million, began operations in 2015, and is expected to operate for at least 50 years. The operating company, AES Chivor, a subsidiary of AES Corporation, controls the concession. Institutional investors own 94% of AES Corporation's shares, including CDPQ, the Canada Pension Plan Investment Board, the New York State Common Retirement Fund, and many others. The **Aquapolo water and sanitation project** in Brazil has a production capacity of 1,000 liters per second, and was built in 2012 at a cost of $158 million. Odebrecht and Sabesp, the São Paulo state waste management company, created the joint venture Aquapolo Ambiental, which operates the project under a 43-year concession. Odebrecht owned 49% of project shares through its subsidiary Odebrecht Ambiental until 2016, when it sold its 70% stake in Odebrecht Ambiental, and its stake in the project, to Brookfield Asset Management and Brookfield's institutional investor partners. Notably, FI-FGTS, Brazil's severance guarantee fund, owns the remaining 30% shares in Odebrecht Ambiental, now known as BRK Ambiental.

The **Jari hydropower plant** in Brazil has an installed capacity of 373MW. Energias do Brasil, a subsidiary of Energias de Portugal (EDP), developed and operates the $1.3 billion power plant and controls the 32-year concession, granted in December 2012. Institutional investors own approximately 20% of EDP's shares, including the Millennium BCP Pension Fund, the Qatar Investment Authority, the Mubadala Investment Company (Abu Dhabi's National Wealth Fund), and Macquarie.

[3] https://www.brookfield.com.

The **Mariscal Sucre international airport** in Ecuador commenced operations in February 2013, and was developed and operated by the international consortium Quiport S.A. (AECON, Airport Development Corporation and HAS Development Corporation, from Canada, and AG-CCR, from Brazil) as a 35-year concession for $700 million. In December 2015, Odinsa of Colombia bought AECON's 45.5% share in the project. Multiple institutional investors own shares in Odinsa, including the Lærernes Pension, the City of New York Group Trust, and the Eaton Vance Collective Investment Trust for Employment Benefits. Table 1 lists the projects with institutional investor participation.

Project	Country	Investor	Participation	Investment
Autopista Mayab	Mexico	CDPQ	Direct	Brownfield
Dominica Wind Farm	Mexico	CDPQ and CKD IM Infraestructura México	Direct	Brownfield
Cerro Dominador CSP	Chile	EIG Global Energy Partners	Indirect	Greenfield
Moquegua Solar PV Plant	Peru	Ardian Infrastructure	Indirect	Brownfield
North Terminal at Port of Callao	Peru	Multiple	Indirect	Brownfield
Santo Antônio Hydropower Plant	Brazil	Multiple	Indirect	Greenfield
Tunjita Hydropower Plant	Colombia	Multiple	Indirect	Greenfield
Aquapolo Water and Sanitation Project	Brazil	Brookfield Asset Management and institutional partners	Indirect	Brownfield
Pozo Almonte Solar PV Project	Chile	Ardian Infrastructure	Indirect	Brownfield
Jari Hydropower Plant	Brazil	Multiple	Indirect	Greenfield
Mariscal Sucre International Airport	Ecuador	Multiple	Indirect	Brownfield
Vías Nuevas de Lima	Peru	Brookfield Asset Management	Indirect	Brownfield

Table 1. Projects with institutional investor participation.

As shown in Table 2, most institutional investors entered infrastructure projects after construction was complete. Institutional investors entered projects in operations in seven out of the twelve cases with institutional investor participation, while in four cases, investors participated in the project since the early development stages. In one project, institutional investors entered in the financing stage. In all seven cases where institutional investors participated in projects during operations, institutional investors entered projects at least two years after the start of operations. Notably, in the four cases where institutional investors

participated in projects since early development, investors engaged indirectly by owning shares in the project company.

Project	Operations (Date)	Investor Entry (Date)	Stage of Entry	Entry Mode
Autopista Mayab	2013 (Start of concession)	April 2015	Operations	Direct equity
Dominica Wind Farm	2015	October 2017	Operations	Direct equity
Cerro Dominador CSP	2017	2016	Financing	Indirect through fund
Moquegua Solar PV Plant	2014	2016	Operations	Indirect through fund
North Terminal at Port of Callao	2011 (start of concession)	Since early development	Early development	Indirect through shares
Santo Antônio Hydropower Plant	2012	Since early development	Early development	Indirect through shares
Tunjita Hydropower Plant	2015	Since early development	Early development	Indirect through shares
Aquapolo Water and Sanitation Project	2012	2016	Operations	Indirect through fund
Pozo Almonte Solar PV Project	2014	2016	Operations	Indirect through fund
Jari Hydropower Plant	December 2012	Since early development	Early development	Indirect through shares
Mariscal Sucre International Airport	February 2013	December 2015	Operations	Indirect through shares
Vías Nuevas de Lima	2013	2015	Operations	Indirect through fund

Table 2. Timing and stage in the project cycle of investor participation.

3.2 Envision Performance of Projects

The projects with institutional participation performed best in the Leadership, Natural World, and Climate and Risk categories. Table 3 summarizes the Envision scores of projects with institutional investor participation, total and per category.

Project	QL	LD	RA	NW	CR	Total
Autopista Mayab	68	47	38	112	20	285
Dominica Wind Farm	75	40	24	38	39	216
Cerro Dominador CSP	128	62	92	77	40	399
Moquegua Solar PV Plant	17	25	31	52	40	165
North Terminal at Port of Callao	47	31	25	73	5	181
Santo Antônio Hydropower Plant	104	76	53	60	46	339
Tunjita Hydropower Plant	24	42	47	50	36	199
Aquapolo Water Sanitation Project	103	95	70	78	12	358
Pozo Almonte Solar PV Project	26	33	47	30	52	188
Jari Hydropower Plant	73	36	41	60	54	264
Mariscal Sucre International Airport	68	53	38	124	16	299
Vías Nuevas de Lima	37	72	41	23	3	176

Table 3. Envision scores of projects with institutional investor participation, total and per category.

4. Quantitative Analysis of Projects

4.1 Findings

The findings that emerged from our quantitative analysis are listed below, followed by more detail on each Envision category and the scores of the projects under review.

Institutional investors engaged in projects mostly through funds or shares in operators

Our analysis shows that institutional investors participated in infrastructure projects primarily indirectly, as only in two of the twelve projects with institutional investor participation, the Mayab highway and the Dominica wind farm in Mexico, had direct equity investments. In both cases the investors participated with a local institutional and/or private partner and do not own the majority of the project shares. In the remaining ten projects, institutional investors participated through a fund in five cases, and own shares in the company that developed the project in the other five cases.

Most institutional investors entered projects in the operations phase

Our analysis shows that most institutional investors entered infrastructure projects later in the project cycle after construction was complete, primarily in the operations phase. In seven out of the twelve projects with institutional investors, investors entered in operations, and in four projects, investors were part of the project since early development stages. In one case, institutional investors entered the project in the financing stage, when construction was ready to begin. In all seven cases with investor participation during operations, investors entered projects at least two years after the start of operations. In two cases, institutional investors entered the project almost three and four years after the start of operations, respectively.

In the four projects where institutional investors were part of the project since early stages of development, investors participated indirectly by owning shares in the project company. We also found that these projects had a notably higher Envision score compared to the average project in aspects related to developing local skills and capabilities, stakeholder engagement, protecting freshwater sources, reducing air pollutant emissions, and managing short-term hazards.

Projects with direct equity participation from an institutional investor perform differently than projects with indirect participation.

The Envision comparative assessment pointed out some notable differences in the Envision performance score of projects with direct institutional equity participation and projects with indirect participation, with each performing better in certain Envision categories. Overall, projects with indirect participation had a slightly higher (three percent) average total Envision performance score. Yet, projects with direct equity participation from an institutional investor on average performed slightly better in Quality of Life, Leadership, and Natural World, while the Envision performance score was equal in both cases in the Climate and Risk category. Projects

with indirect participation performed substantially better in Resource Allocation, which resulted in a slightly higher total Envision score.

Institutional investors engage directly in projects when a trusted local partner exists

In both cases where investors participated in infrastructure through direct equity investments, it was with a local institutional and/or private partner that was considered established and experienced. In the Mayab highway, CDPQ partnered with the Mexican infrastructure firm ICA, which has substantial experience in developing and operating highways as concessions. In the Dominica wind farm, CDPQ partnered with a consortium of Mexican institutional investors through CKD IM Infraestructura México, while Enel Green Power through its subsidiary Enel Green Power México also retained a minor share in the project. Furthermore, institutional investors did not own the majority of the project, leaving the local partner responsible for operations.

Institutional investors preferred countries that strive to increase institutional investments in infrastructure

Institutional investors participated in projects developed in six countries: Mexico, Chile, Peru, Brazil, Colombia, and Ecuador. With the exception of Ecuador, these countries are consistently cited as those in LAC that have made the most significant efforts to facilitate private and institutional investments in infrastructure. It is important to note that the two projects with direct institutional investment participation were both in Mexico, which has taken extensive measures to increase the participation of institutional investors in infrastructure.

Institutional investors preferred sectors with the most advanced and mature PPP markets in LAC

Institutional investors participated in projects in three infrastructure sectors: energy (seven projects), transportation (four projects), and water and sanitation (one project). Energy and transportation are the infrastructure sectors with the highest private participation and the oldest and most mature PPP markets in the LAC region, while water utility projects offer long-term tariffs for the provision and/or treatment of water. In fact, the wide majority of these projects offer predictable long-term returns through concessions (highways), Power Purchasing Agreements (all energy projects), and service agreements (wastewater utility).

Institutional investors preferred projects with a higher performance on social sustainability and climate resiliency

Although the average Envision performance of projects with institutional investors did not differ significantly from the score of projects without institutional investors, our analysis shows that certain sustainability aspects, especially in the Quality of Life, Natural World, and Climate and Risk categories, stand out in projects with institutional investors. Specifically, institutional

investors participated in projects that more comprehensively covered aspects related to local skills and capacity building, collaboration and stakeholder engagement, sustainability management systems, sustainable procurement, protecting freshwater resources, and assessing climate risks and short-term hazards.

The projects with direct institutional investor participation had a substantially higher Envision score compared to the average project in credits, covering community capacity building, stakeholder engagement, preserving local views and public space, protecting water sources, and assessing climate and short-term hazards. All these aspects indicate some of the sustainability issues that are likely among the most significant for institutional investors, which should be disseminated and addressed in infrastructure projects.

4.2 Overall Envision Performance

Overall, we did not find major differences in the total Envision performance of projects with and without institutional investor participation. The average Envision performance of projects was 3% higher than the Envision score of the projects with institutional investors, which is an insignificant difference. Six projects with institutional investors had a higher total Envision performance score than the average project, with the difference in performance ranging from 1% to 52%. Significant differences in the total Envision performance were not observed between projects with direct or indirect institutional participation.

Looking into the different Envision categories, projects with institutional investors had a slightly higher average score in the **Leadership** and **Climate and Risk** categories, outperforming the average project by 8% and 9%, respectively. However, projects with institutional investors had lower scores in the Quality of Life, Resource Allocation, and Natural World categories, with the difference to the average project being 13%, 5%, and 2% lower, respectively.

Table 4 summarizes the average and median Envision performance score per Envision category for projects with institutional investors and the average project without institutional investors.

Envision Category	Projects with institutional investors		Projects without institutional investors	
	Avg	Mdn	Avg	Mdn
Quality of Life	64	68	73	74
Leadership	51	45	47	46
Resource Allocation	46	41	48	43
Natural World	65	60	66	70
Climate and Risk	30	38	28	27
Total Score	256	240	263	261

Table 4. Average and median Envision performance score per Envision category for projects with institutional investors and the average project without institutional investors.

4.3 Quality of Life Performance

In the Quality of Life category, projects without institutional investors on average outperformed the projects with institutional investors by 13%. Both projects with direct and indirect investor participation have a lower average total Quality of Life score.

However, the Envision credit-by-credit analysis pointed out some notable differences, as the Envision score of specific credits differed considerably within projects. These are the credits that encourage and award initiatives to develop local skills and capabilities, safeguard public health and safety, and site accessibility and safety, all of which had a higher score in projects with institutional investors compared to the average project. The projects with direct institutional investor participation also have a higher Envision score in credits covering aspects related to preserving views and local character, and enhancing public space.

Table 5 summarizes the differences between Envision scores in each Quality of Life credit between projects with and without institutional investors. The color green indicates the credits with a higher average score than the average project without institutional investors. Red indicates the credits with a lower average score than the average project without institutional investor. A dash indicates the credits where either the projects with investors or the projects without investors had a zero score, and no comparison was made.

QUALITY OF LIFE	Investor Participation							
	All projects with investors		Direct Participation		Indirect through Fund		Indirect through Company Shares	
	Avg	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**
QL1.1 Improve Community Quality of Life	-31%	-50%	0%	-25%	-41%	-90%	-33%	-50%
QL1.2 Stimulate Sustainable Growth and Development	-3%	80%	-9%	50%	-15%	-80%	11%	160%
QL1.3 Develop Local Skills and Capabilities	19%	0%	38%	70%	-25%	-60%	56%	140%
QL2.1 Enhance Public Health and Safety	13%	350%	17%	350%	30%	700%	-7%	0%
QL2.2 Minimize Noise and Vibration	-46%	-88%	-85%	-88%	-27%	0%	-48%	-88%
QL2.3 Minimize Light Pollution	-59%	-	-29%	-	-43%	-	-86%	-
QL2.4 Improve Community Mobility and Access	6%	0%	-26%	0%	37%	75%	-11%	0%
QL2.5 Encourage Alternative Modes of Transportation	-3%	-	-100%	-	-71%	-	104%	-
QL2.6 Improve Site Accessibility, Safety and Wayfinding	15%	50%	-1%	50%	45%	100%	-8%	0%
QL3.1 Preserve Historic and Cultural Resources	-13%	-43%	-35%	-43%	8%	-86%	-25%	0%
QL3.2 Preserve Views and Local Character	-34%	-83%	98%	42%	-86%	-83%	-35%	-83%
QL3.3 Enhance Public Space	-12%	0%	27%	450%	-35%	-100%	-3%	0%
QL0.0 Innovate or Exceed Credit Requirements	-37%	-	0%	-	11%	-	-100%	-

Table 5. Differences in Envision score in Quality of Life between projects with and without institutional investors.

4.4 Leadership Performance

In the Leadership category, the projects with institutional investors have an 8% higher Envision performance. The projects with indirect institutional investor participation performed significantly better in this category, outperforming the projects without institutional investors by 22%.

The Envision credit-by-credit assessment shows that institutional investors participated in projects that performed significantly higher in two specific Envision credits: Those that reward

the establishment of a sustainability management system, and those that promote collaboration and teamwork. The projects with direct institutional investor participation performed better in Envision credits that cover aspects related to providing effective leadership and commitment and stakeholder involvement. Notably, the projects with indirect investor participation had a substantially higher score in Envision credits covering by-product synergy opportunities, improving infrastructure integration, and extending the project's useful life.

Table 6 summarizes the differences between the average and median Envision score in each Leadership credit between projects with without institutional investors. The color green indicates the credits with a higher average score than the average project without institutional investors. Red indicates the credits with a lower average score than the average project without institutional investor. Dashes indicate the credits where either the projects with investors or the projects without investors had a zero score, and no comparison was made.

LEADERSHIP	Investor Participation							
	All projects with investors		Direct Participation		Indirect through Fund		Indirect through Company Shares	
	Avg	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**
LD1.1 Provide Effective Leadership and Commitment	6%	0%	26%	44%	10%	89%	-7%	0%
LD1.2 Establish a Sustainability Management System	24%	0%	17%	0%	33%	-43%	17%	0%
LD1.3 Foster Collaboration and Teamwork	50%	0%	-27%	-38%	86%	0%	45%	0%
LD1.4 Provide for Stakeholder Involvement	1%	0%	41%	90%	-26%	0%	13%	0%
LD2.1 Pursue By-Product Synergy Opportunities	-9%	-	-100%	-	84%	-	-66%	-
LD2.2 Improve Infrastructure Integration	10%	0%	-37%	-29%	27%	0%	12%	0%
LD3.1 Plan for Long-Term Monitoring and Maintenance	-1%	-35%	-8%	-45%	10%	0%	-10%	-70%
LD3.2 Address Conflicting Regulations and Policies	-50%	0%	-53%	0%	-81%	-100%	-16%	100%
LD3.3 Extend Useful Life	-4%	100 %	-100%	-100%	68%	200%	-37%	0%
LD0.0 Innovate or Exceed Credit Requirements	-	-	-	-	-	-	-	-

Table 6. Differences in Envision score in Leadership between projects with and without institutional investors.

4.5 Resource Allocation Performance

In Resource Allocation, the average Envision performance of projects with institutional investors was 5% lower than the average project without institutional investors. Notably, projects with indirect institutional investor participation performed significantly higher than the projects with direct participation in the Resource Allocation category.

Overall, in the projects with institutional investors, four Resource Allocation credits had an Envision score higher than the average project, covering aspects related to sustainable procurement practices, the use of recycled materials, diverting waste from landfills, and protecting fresh water availability. In the projects where institutional investors participated directly, our analysis shows that Envision credits that encourage the use of recycled and regional materials were addressed more comprehensively. The projects with indirect institutional investor participation through funds on average performed better in four additional credits that address reducing excavated materials taken off site, providing for deconstruction and recycling, using renewable energy, and reducing potable water consumption.

Table 7 summarizes the differences between the average and median Envision score in each Resource Allocation credit between projects with and without institutional investors. The color green indicates the credits with a higher average score than the average project without institutional investors. Red indicates the credits with a lower average score than the average project without institutional investor. Dashes indicate the credits where either the projects with investors or the projects without investors had a zero score, and no comparison was made.

RESOURCE ALLOCATION	Investor Participation							
	All Projects with Investors		Direct Participation		Indirect through Fund		Indirect through Company Shares	
	Avg	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**
RA1.1 Reduce Net Embodied Energy	-100%	-	-100%	-	-100%	-	-100%	-
RA1.2 Support Sustainable Procurement Practices	37%	0%	6%	0%	59%	0%	27%	0%
RA1.3 Use Recycled Materials	102%	0%	350%	300%	103%	0%	1%	0%
RA1.4 Use Regional Materials	-33%	-100%	14%	0%	-54%	-100%	-32%	-100%
RA1.5 Divert Waste From Landfills	34%	0%	-9%	0%	9%	0%	76%	100%
RA1.6 Reduce Excavated Materials Taken Off Site	-6%	13%	-17%	-25%	16%	25%	-23%	-50%
RA1.7 Provide for Deconstruction And Recycling	-19%	-	-71%	-	72%	-	-89%	-
RA2.1 Reduce Energy Consumption	-72%	-	-100%	-	-55%	-	-78%	-
RA2.2 Use Renewable Energy	-3%	-25%	-82%	-88%	16%	25%	9%	25%
RA2.3 Commission and Monitor Energy Systems	-36%	-73%	5%	-36%	-25%	-73%	-64%	-73%
RA3.1 Protect Fresh Water Availability	11%	0%	-83%	-50%	27%	0%	33%	100%
RA3.2 Reduce Potable Water Consumption	-4%	-100%	-100%	-100%	131%	0%	100%	-100%
RA3.3 Monitor Water Systems	-15%	200%	-51%	50%	-14%	200%	-1%	200%
RA0.0 Innovate or Exceed Credit Requirements	-	-	-	-	-	-	-	-

Table 7. Differences in Envision score in Resource Allocation between projects with and without institutional investors.

4.6 Natural World Performance

In the Natural World category, the average Envision performance of projects with and without institutional investors was almost equal, with the latter having a 2% higher average score. Notably, projects where investors participated directly had a 13% higher score in the Natural World category, as compared to the average project without institutional investors. Through the

credit-by-credit analysis we observe that institutional investors participated in projects that scored higher in four Envision credits: protecting wetlands and surface water, managing stormwater, reducing pesticide and fertilizer impacts, and preventing surface and groundwater contamination. Institutional investors participated directly in projects that scored higher in aspects related to preserving prime habitat, avoiding adverse geology, preserving floodplain functions, avoiding unsustainable development on steep slopes, and preserving species biodiversity. Table 8 summarizes the differences between the average and median Envision score in each Natural World credit between projects with and without institutional investors. The color green indicates the credits with a higher average score than the average project without institutional investors. Red indicates the credits with a lower average score than the average project without institutional investor. Dashes indicate the credits where either the projects with investors or the projects without investors had a zero score, and no comparison was made.

NATURAL WORLD	Investor Participation							
	All Projects with Investors		Direct Participation		Indirect through Fund		Indirect through Company Shares	
	Avg	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**
NW1.1 Preserve Prime Habitat	4%	0%	69%	50%	2%	0%	-20%	0%
NW1.2 Protect Wetlands and Surface Water	29%	-100%	275%	650%	-80%	-100%	40%	-100%
NW1.3 Preserve Prime Farmland	-20%	-100%	-100%	-100%	16%	100%	-23%	-100%
NW1.4 Avoid Adverse Geology	8%	0%	40%	33%	-9%	-33%	12%	0%
NW1.5 Preserve Floodplain Functions	4%	75%	93%	225%	-29%	0%	1%	0%
NW1.6 Avoid Unsuitable Development on Steep Slopes	3%	25%	41%	25%	13%	50%	-21%	-75%
NW1.7 Preserve Greenfields	9%	-	-100%	-	29%	-	32%	-
NW2.1 Manage Stormwater	37%	-50%	-36%	-50%	-16%	-100%	119%	0%
NW2.2 Reduce Pesticide and Fertilizer Impacts	13%	-100%	103%	350%	-19%	-100%	8%	0%
NW2.3 Prevent Surface and Groundwater Contamination	13%	0%	46%	88%	-26%	0%	40%	0%
NW3.1 Preserve Species Biodiversity	3%	0%	48%	350%	-21%	0%	9%	0%
NW3.2 Control Invasive Species	-17%	-50%	-38%	-50%	-55%	-100%	30%	0%
NW3.3 Restore Disturbed Soils	-9%	0%	-32%	-50%	-18%	0%	9%	0%
NW3.4 Maintain Wetland and Surface Water Functions	-45%	-83%	10%	0%	-93%	-100%	-19%	0%
NW0.0 Innovate or Exceed Credit Requirements	100%	-	-100%	-	-100%	-	380%	-

Table 8. Differences in Envision score in Natural World between projects with and without institutional investors.

4.7 Climate and Risk Performance

In Climate and Risk, projects with institutional investors had a 10% higher Envision score than those without institutional investors. In this Envision category, both projects with direct and indirect investor participation performed better than projects without institutional investors.

The credit-by-credit analysis shows that investors participated in projects scoring higher in four Envision credits covering air pollutant emissions, assessing climate threats, preparing for short term hazards, and innovative project designs that exceeded Envision performance requirements. Notably, the projects with direct investor participation had a substantially higher score in the credit that awards the assessment of climate threats. Similarly, the projects with indirect investor participation had a substantially higher score in the credit that addresses the reduction of air pollutant emissions.

Table 9 summarizes the differences between the average and median Envision score in each Climate and Risk credit between projects with and without institutional investors. The color green indicates the credits with a higher average score than the average project without institutional investors. Red indicates the credits with a lower average score than the average project without institutional investor. Dashes indicate the credits where either the projects with investors or the projects without investors had a zero score, and no comparison was made

CLIMATE AND RISK	Investor Participation							
	All Projects with Investors		Direct Participation		Indirect through Fund		Indirect through Company Shares	
	Avg	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**	**Avg**	**Mdn**
CR1.1 Reduce Greenhouse Gas Emissions	-6%	38%	-14%	-4%	-7%	38%	-1%	38%
CR1.2 Reduce Air Pollutant Emissions	31%	0%	-78%	-50%	73%	500%	33%	0%
CR2.1 Assess Climate Threat	125%	-	1250%	-	-100%	-	-100%	-
CR2.2 Avoid Traps and Vulnerabilities	-12%	-	-4%	-	-42%	-	16%	-
CR2.3 Prepare for Long-Term Adaptability	-100%	-	-100%	-	-100%	-	-100%	-
CR2.4 Prepare for Short-Term Hazards	86%	117 %	70%	117%	52%	0%	125%	233%
CR2.5 Manage Heat Island Effects	-100%	-	-100%	-	-100%	-	-100%	-
CR0.0 Innovate or Exceed Credit Requirements	125%	-	-100%	-	440%	-	-100%	-

Table 9. Differences in Envision score in Climate and Risk between projects with and without institutional investors.

5. Qualitative Analysis of Projects

Our analysis continued with the qualitative aspects of infrastructure projects that attracted institutional investors. We examined the initiatives and specific project design aspects of each of the twelve identified projects and consolidated our qualitative data. We present our analysis in this section.

In summary, all projects with institutional investor participation implemented **exceptional sustainability initiatives** that helped them achieve high Envision performance scores in all five Envision categories. In all twelve projects, designated initiatives focused on employing local community members for project works. Furthermore, capacity building initiatives, educational programs, and social development plans helped each project make a quantifiable contribution to sustainable community growth and development, thereby minimizing the potential for conflicts and grievances to arise during construction and operations. Context-sensitive design approaches were followed to minimize visual impacts and protect public space, ensuring that the projects would integrate well into the landscape and the existing infrastructure network.

Social and environmental management systems were implemented in all projects with institutional investors, addressing the impacts identified through the environmental impact assessments. The management systems in the two projects with direct institutional investor participation specify **annual performance goals** for sustainability improvements, such as recycling and community engagement events, while sustainability performance is reported annually through an official sustainability report. Furthermore, the projects include **comprehensive long-term monitoring and maintenance** plans to ensure that the projects are properly maintained, which has a positive impact in extending each project's useful life.

All projects with institutional investor participation, especially the two with direct institutional equity investments, include **comprehensive stakeholder and community engagement** programs. An innovative aspect is the inclusion of public disclosure and grievance redress mechanisms for project-related aspects that are instrumental in addressing grievances in a timely manner. In regards to the **use of resources**, the projects with institutional investor participation use materials with recycled content, minimized the excavation and movement of soils during construction, and developed comprehensive waste management plans to avoid disposing of useful materials in landfills. Notably, all projects with institutional investor participation have either implemented or have planned initiatives to **utilize renewable energy** to cover the project's energy needs.

Natural ecosystems were avoided for project developments, and when that was not possible due to the typology of the project, for example in the case of hydropower projects, extensive management and monitoring initiatives were implemented to minimize negative environmental impacts. Notably, institutional investors participated directly in projects that on average implemented more comprehensive efforts to **preserve natural habitats**, protect water ecosystems, and avoid risks from adverse geology.

Short and long-term risks were assessed in all projects through **risk and hazard assessments**, while all projects include management plans specifying the actions to be followed during hazard events. Most projects with institutional investor participation include monitoring and

management plans for air pollutant and greenhouse gas emissions. Although not all projects have quantified the expected greenhouse gas emissions of the project, all projects include initiatives that have a quantifiable impact in reducing emissions, such as using energy and water-efficient equipment and materials, generating renewable energy, and implementing recycling strategies that minimize landfill disposal, among others. Yet, the impact of these initiatives is not always quantified.

5.1 Qualitative Analysis Findings

Institutional investors participated in projects with a quantifiable impact in enhancing sustainable growth and development

Our analysis shows that all of the projects with institutional investors clearly facilitated the sustainable development of the community by providing jobs, capacity building, infrastructure services and new economic opportunities, often in isolated regions with high development needs. The projects clearly satisfied the identified needs for the provision of infrastructure services, for example by connecting remote and isolated regions, providing wastewater treatment services in a region that lacked wastewater treatment services, and contributing net positive amounts of renewable energy, resulting in a net positive impact on the quality of life and the economy at both the local and national levels.

Institutional investors participated directly in projects with comprehensive sustainability management systems, community engagement, and grievance redress programs

Our analysis shows that continuous community engagement was among the top priorities in projects with institutional investors, especially in the projects with direct institutional equity placements. Notably, social development programs focused on involving the communities in the project during planning and construction, and include designated initiatives to solicit community feedback and address grievances in a timely manner. In addition, the projects with direct institutional investments include social development programs with multiple initiatives to enhance the skills and capacities of local communities, restore and improve infrastructure and educational facilities, and assist them to develop sustainably.

Institutional investors preferred projects that avoid or minimize impacts on critical ecosystems

All projects with institutional investors either avoided natural ecosystems completely by choosing an alternative site, or implemented comprehensive environmental management and monitoring initiatives to avoid disturbing critical ecosystems, especially surface water sources and wetlands. Appropriate buffer zones were established to protect water resources, which in some cases extend to almost 400 meters. Even in projects located in arid regions without sensitive natural environments nearby, monitoring plans ensure that the projects would not negatively affect the region’s water. In the case of hydropower projects that inevitably impact

water ecosystems, appropriate measures were taken to quantify any potential negative impacts and implement initiatives to ensure that overall project impacts are net positive.

Institutional investors chose projects with comprehensive assessments of risks and hazards, as well as extensive management programs for greenhouse gas emissions

In all projects with institutional investors, extensive measures were implemented to manage the generation of greenhouse gas emissions, while some projects result in a substantial net reduction of emissions, primarily through renewable energy generation. The impact of various design initiatives, such as using energy-efficient materials in reducing emissions, has not been quantified in all of the projects, but all projects include at least one major intervention that is expected to reduce emissions. In addition, all projects with institutional investors comprehensively identified and assessed hazards and risks, including monitoring and emergency management plans to address risks and hazards when required.

6. Conclusion

The constantly increasing demand for infrastructure services has forced governments to look for alternative methods to finance infrastructure projects than the traditional public financing model. Yet, although institutional investors are consistently highlighted among the most promising potential sources of capital for infrastructure financing, their participation in infrastructure projects overall remains limited, in the LAC region and worldwide. Our paper identifies the key project and country parameters that attract institutional investors' equity participation in infrastructure that should be studied by national governments to incentivize greater institutional investors' participation in infrastructure investments. Future research can focus on evaluating a larger sample of projects with institutional investor participation, as well as consider additional pathways of institutional investor participation in projects, such as debt or bond financing.

Our research shows that institutional investors participated in projects mostly indirectly, through funds or shares in operators. Only two of the twelve projects with institutional investor participation had direct equity investments. Furthermore, institutional investors engaged directly in projects with a trusted local partner, which in both cases was an established firm experienced in developing and operating infrastructure projects in the LAC region. Notably, institutional investors did not own the majority of the project, leaving the local partner responsible for decision-making and operations.

Most investors entered projects in the operations stage, which further supports findings in the literature stating that projects under development (greenfield investments) are regarded as more risky. Enhancing capacities for sustainable upstream planning and project delivery is critical to ensure investors and developers that project risks are adequately evaluated in the investment evaluation process, promoting the selection of prudent projects and more transparent project pipelines. Investors are much less likely to participate in infrastructure projects, especially in the early development stages, when projects are sited in conflictive locations and risks are not properly evaluated, which might lead to conflicts that increase the likelihood of delays and cost overruns.

Since institutional investors preferred countries that strive to increase institutional investments in infrastructure, governments should evaluate the efforts of these countries to increase institutional investor engagement in infrastructure investments and implement similar initiatives. Institutional investors are not able to participate in infrastructure investments if they are prohibited to do so by national law, or when stringent portfolio thresholds limit institutional capital allocations in infrastructure projects. For instance, governments can follow the example of Peru and Mexico and ease quantitative portfolio limits for institutional investments in infrastructure and consider the development of institutional infrastructure funds.

Extending capacity-building efforts to increase the effectiveness of the infrastructure PPP market is another notable recommendation, as institutional investors preferred projects in advanced and mature PPP markets that offer predictable long-term returns through concessions (highways), power purchasing agreements (all energy projects), and service agreements (wastewater utility). PPP and general procurement frameworks should ensure that sustainability benefits and risks are evaluated, and that all parties in a PPP can adequately manage project

risks and responsibilities. Capacity-building efforts should focus on both the project preparation stage, including contractual design, and operations, which is critical in avoiding costly contract modifications and retrospective changes.

The Envision sustainability assessment pointed out some notable sustainability aspects that stood out in projects with institutional investors. Overall, institutional investors preferred projects with a higher performance on social sustainability and climate resiliency, and in which aspects related to local skills and capacity building, collaboration and stakeholder engagement, sustainability management systems, sustainable procurement, protecting freshwater resources, and assessing climate risks and short-term hazards were covered more comprehensively.

Institutional investors participated directly in projects that had a substantially higher Envision score compared to the average project in credits covering community capacity building, stakeholder engagement, preserving local views and public space, protecting water sources, and assessing climate and short-term hazards. The upstream planning frameworks of LAC countries should be evaluated on whether they address these and other sustainability aspects further upstream while planning and developing infrastructure projects, and specify the necessary improvements and additions in order to design and implement more sustainable projects.

Overall, these aspects indicate the prevailing institutional and sustainability issues that are likely among the most significant for institutional investors, which should be disseminated and addressed in infrastructure projects to facilitate institutional investor engagements in sustainable infrastructure investments.

Abbreviations

AUM: Assets Under Management

CDPQ: Caisse de Dépôt et Placement du Québec

GDP: Gross Domestic Product

IDB: Inter-American Development Bank

MDB: Multilateral Development Bank

LAC: Latin America and the Caribbean

PPP: Public-Private Partnership

SDGs: Sustainable Development Goals

Appendices

Appendix A: Literature Review

Institutional Investors in Latin America and the Caribbean

Given the substantial gap in Latin American infrastructure and the constraints on public financing, institutional investors are seen as favorable financing sources for infrastructure projects in LAC as in all other regions of the world. Institutional investors in LAC hold approximately $1 trillion in AUM, with the largest pension fund portfolios observed in Chile ($165 billion, 69.5% of GDP), Colombia ($96 billion, 20% of GDP), Peru ($39 billion, 19.4% of GDP), Brazil ($480 billion, 16.1% of GDP), and Mexico ($159 billion, 14.2% of GDP) (Tuesta, 2015).

However, as in all other regions around the world, the participation of institutional investors in infrastructure projects is so far insignificant in LAC. Specifically, the average 2014 pension fund direct investment in Brazil, Colombia, Chile, Mexico, and Peru in infrastructure accounted for 2.6% of their portfolio, with ranges from 0.7% to 4.8% (Tuesta, 2015).

Pathways of Investment in Infrastructure

Institutional investors participate in infrastructure projects either directly through equity stakes or debt holding, or indirectly through infrastructure funds (commercial, or provided by government institutions, such as public-private partnership (PPP) funds). Worldwide, institutional investor involvement in infrastructure is primarily indirect via infrastructure funds (Inderst and Steward, 2014). Direct equity and debt investments are rare in infrastructure, yet more common in LAC than in other regions, observed primarily in large utility and telecom companies that are privatized (Inderst and Steward, 2014). Institutional investors are generally interested in privatization efforts (Inderst and Steward, 2014).

For direct investments, institutional investors can be single investors through private infrastructure holding companies, can partner with other institutional investors for large-scale projects, or partner with commercial banks and private firms. Indirect investments through funds allow for risk diversification as multiple institutional investors invest in several projects collectively. Inderst and Steward (2014) report that several infrastructure funds exist, through commercial funds in the form of private equity funds, mutual funds, and listed investment trusts. Some funds are even supported by governments, national agencies, and multilateral development banks (MDBs).

Infrastructure investment choice depends largely on the size of the institutional investor. Lokmanis (2016) divides institutional investors in three categories: small and midsized (under $3 billion), large ($5 billion to $25 billion), and very large ($25 billion or more in net assets). Small and midsized institutional investors invest in infrastructure indirectly through funds that participate in multiple assets. Large institutional investors invest through funds and also co-invest with fund partners to diversify their portfolios. Direct investments usually require significant capital and are most commonly pursued by very large investors that have the financial and investment management capabilities to pursue large infrastructure projects.

Conditions for Engagement in Infrastructure

Infrastructure projects face significant risks, including construction and development risks that may cause cost overruns; project delays and/or cancellations; poor governance and corruption risks; changes in infrastructure policies, regulations or general government attitude, among others (Watkins et al., 2017). In general, institutional investors are not experienced in infrastructure investments (Inderst and Steward, 2014), which makes them particularly risk-averse when considering infrastructure investments. Reducing such risks through well-planned, designed and executed project pipelines is key to facilitate institutional investor participation (Inderst and Steward, 2014; Mercer, 2017).

Mercer (2017) reports that institutional investors mention lack of transparent project pipelines as one of the most significant barriers hindering institutional investments in infrastructure. Infrastructure sector policies are often not prudently coordinated as part of national infrastructure plans and subject to retrospective changes, hindering investor confidence in the suitability and profitability of infrastructure projects. Institutional investors evaluate the enabling background environment for infrastructure development before they consider investing in an infrastructure project. Inderst and Steward (2014) report that this includes the state of the financial system and capital markets, the nature, size, and regulation of institutional investors in the country, infrastructure policies, taxation and regulation, frameworks for private-sector investment in infrastructure, and the economic and political macro-environment (such as political stability, rule of law, regulatory certainty, and institutions).

Institutional investor engagement is not only influenced by the economic development level of a country or the openness of its economy, but also by the state of the law and governance, and the legal, regulatory, and tax systems, as institutional investors value greatly the potential for clear and stable regulations (Tuesta, 2015). Institutional investment in infrastructure is often limited by national regulations (e.g. laws prohibiting pension fund investment in infrastructure or imposing quantitative investment constraints). However, Tuesta (2015) states that the institutional capacity of countries is the most critical consideration: "*Rule of law, institutional factors and government commitment to reduce uncertainty are key [for institutional investors] to invest more in infrastructure in LAC*."

Institutional Investor Preferences

In general, the energy, transportation, and telecom sectors show the highest percentage in private participation, while Brazil, Chile, Peru, Colombia, and Mexico are the countries with the most significant pension schemes and the most advanced PPP markets in Latin America. OECD (2015) reports that transportation (primarily highways) and energy are the largest allocations among pension funds that participated in the pension fund survey report. Notably, pension funds are likely attracted by the long-term tariff arrangements in transportation (highways) and energy projects (utilities).

Within the energy sector, institutional investments in renewable energy are relatively new and small, but constantly increasing. Transportation and conventional energy projects offer more attractive opportunities primarily because of market barriers (perverse incentives and prevailing fossil fuel prices) and renewable energy policy risks (OECD, 2016b). Yet, institutional investors

are becoming major equity investors in European wind projects, accounting for 37% of total equity invested in wind projects in 2015. Notably, pension funds and insurers only invested in brownfield projects (OECD, 2016b).

OECD's 2015 Large Pension Funds Survey reports that in general pension funds perceive greenfield projects as riskier and prefer involvement in operational (brownfield) assets. This is also supported by Mercer (2017) and PwC and GIIA (2017), which state that institutional investors generally invest in operating (brownfield) projects, primarily because they pose fewer risks and challenges.

Institutional investor confidence to invest in infrastructure projects is contingent upon any country's overall risk levels, investment climate, policy and institutions (OECD, 2016a). Tuesta (2015) reports that Colombia, Mexico, Chile, and Peru have established and updated their financial instruments within the last decade to facilitate institutional investments in infrastructure. In Peru, for instance, pension funds were allowed to develop a trust that holds $1.4 billion that can be invested in infrastructure funds. In Mexico, where 8.4% of pension fund portfolio is invested in infrastructure, is developing financial instruments, such as the Fideicomiso de Infraestructura y Bienes Raíces (FIBRA) funds (Alonso et al., 2015), to encourage pension fund investment in infrastructure.

Prevailing Institutional Gaps that Limit Investment in Infrastructure

The rule of law and the business climate are often cited among the most important factors that hinder the increased engagement of institutional investors in infrastructure. Without certainty and stability in the legal and regulatory environments, institutional investors would avoid investing in infrastructure in any country (PwC and GIIA, 2017). Mercer (2017) further states that institutional investors reported unfavorable and uncertain regulations and policies and lack of institutional capacity to develop transparent project pipelines as the prevailing institutional gaps.

Such gaps also include the absence of a viable PPP legal framework, insufficient capacity for project planning, design and implementation, poor accountability performance and project management, lack of credit culture in public infrastructure operations, and lack of guarantees offering a predictable policy and regulatory environment (Shendy et al., 2011; Inderst and Steward, 2014).

Yet, although the literature abounds with reports stating the potential role of institutional investors in closing the infrastructure gap in the LAC region, the institutional arrangements that are necessary to attract institutional investors in infrastructure projects have not been clearly identified. The specific conditions that facilitate or prohibit investor engagement in projects have not been properly evaluated, especially the policies, regulations, and legislation that are required for institutional investor participation in what may be deed as sustainable infrastructure investments. Identifying and disseminating these conditions and the relevant institutional gaps is necessary in order to facilitate increased institutional investor participation in projects that avoid impacting the environment and enhance the quality of life of local communities.

Appendix B: IDB Infrastructure 360 Project Database

	Project	Location
1	Juan Santamaria International Airport	Costa Rica
2	Peralta Wind Farm	Uruguay
3	Autopista Mayab (Autopista Kantyunil-Cancun-Playa del Carmen)	Mexico
4	Los Cocos Wind Farm	Dom. Republic
5	LT- Amazonas Transmission Line Project	Brazil
6	Nuevo Necaxa-Avila Camacho Highway Project	Mexico
7	Proyecto Hidroeléctrico Los Hierros	Chile
8	Aura Solar PV I	Mexico
9	Línea 1 Metro de Lima	Peru
10	Planta de Tratamiento de Aguas Residuales y Emisario Submarino La Chira	Peru
11	Aeropuerto Ecologico de Galapagos	Ecuador
12	Palmatir Wind Farm	Uruguay
13	Juan Santa Maria Airport	Costa Rica
14	Mariscal Sucre International Airport	Ecuador
15	Vías Nuevas de Lima	Peru
16	Centrales de Pasada Carilafquen Malalcahuello	Chile
17	Florida Wind Farm	Uruguay
18	Cerro de Hula Wind Project	Honduras
19	EURUS Wind Farm	Mexico
20	Terminal de Contenedores de Cartagena, Contecar	Colombia
21	Circuito Interior de la Ciudad de México	Mexico
22	Planta de Concentración Solar Cerro Dominador	Chile
23	Moquegua PV Plant	Peru
24	North Terminal at Port of Callao	Peru
25	Usina Hidrelétrica Santo Antônio	Brazil
26	Tunjita Hydropower Project	Colombia
27	Aquapolo Wastewater Treatment Plant	Brazil
28	Bahía Port Bahía	Colombia
29	Choluteca PV Solar	Honduras
30	ChilcaUno	Peru
31	Buen Ayre Plant	Argentina
32	Planta de Tratamiento de Aguas Residuales Atotonilco (P.T.A.R.)	Mexico
33	Parque Eolico Dominic	Mexico
34	CTR Rio	Brazil
35	Termoverde Caieiras	Brazil
36	8 de Agosto Hydroelectric Power Plant	Peru
37	Point Fortin Seawater Reverse Osmosis Desalination Facility	Trinidad
38	PORT TEGRAM (Maranhão Grain Terminal)	Brazil
39	UCUQUER II Wind Farm	Chile

Appendix C: Descriptions of Selected Projects and Key Sustainability Initiatives

Twelve projects in the IDB Infrastructure 360 Project Database involve the participation of institutional investors, and were included in this study. They are:

1. Autopista Mayab, Mexico

The Kantunil-Cancun highway project (also known as Autopista Mayab) is located in Mexico, and consists of the modernization and operation of the highway 180 that spans 250 km from Kantunil to Cancun's International Airport Exchange, along with the construction of a new 61,2 km long highway segment towards Playa del Carmen. The project is owned by the Secretaría de Comunicaciones y Transporte, and developed and operated as a 25-year concession by the Consorcio del Mayab, S.A. de C.V. Empresas ICA, a Mexican infrastructure firm, owns 51% of the concession, and the remaining 49% is owned by the Canadian institutional investor Caisse de dépôt et placement du Québec (CDPQ). Construction works began on December 2011, and the concession commenced on May 15, 2013. The total investment is estimated at US$422,95 million.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Socio-economic **initiatives – 3 programs**:
    - Adopt a school
    - ICA AYUDA
    - Engage a school

  ➔ focused on **raising awareness** on sustainability topics and on creating a **beneficial space for the children and the community** at large [donating recycling and compost bins, sustainability roundtables and workshops, and providing INEA in the community (adult alphabetization and education) sessions]
- **Conferences and seminars** addressed at the community needs and how to instill more sustainable practices
- An **education program** tailored to the specific needs of the employees and educating them on sustainability practices at the workplace.
- Results of the education and conference programs are evidenced in individual worker assessments → educational units & credit hours achieved

Community

- Strong move towards **public safety** in combination with **sustainability** practices
- Modification of certain segments of the highway to **avoid floodable areas**/risk identification → mitigation strategies to eliminate hazards to the health of the community and workers

- A system for **Education and worker self-protection** along with education and risk management in the workplace
- Two **courses** prepare the staff to deal with new technologies
- **Workplace emergency plan** with integrated **Civil Protection Plan** in the case that non-employees are the subject of an accident, or an emergency arises
- Implemented a clear system to prevent and handle emergencies - **documentation** clear enough for each group
- Community outreach programs: distribution of electronic and physical **brochures**
    - public can understand the safety signage
    - inform about highway protection plan in case of an accident or emergency within the highway

→ Successful at developing and implementing a public safety and at making it accessible to every party

- **Online catalog** → get acquainted with the signage and their meanings

Well – being

- The team has taken steps to promote and preserve local artisans and cultural resources
- They do so by hosting **artisanal exposition** that exhibit these talents and at the same time promote the **economic growth of the region** by creating a **feasible market** for the artisans
- Agreement with INAH (Instituto Nacional de Antropología e Historia) to inform and preserve any archeological findings related to the ancient cultures of the site
- The team has designed low lying highway that closely aligns with the natural slope of the geomorphology in the site in order to eliminate the deterioration of the natural landscape
- Plan to rescue lost habitat and restore landscapes that the project adversely impacts (the landscape of the region not only has a visual importance but also characterized the local culture and character)

Leadership

Collaboration

- **Annual reports** that aim for better sustainable performance (implementation of recycling & community outreach program, reduction of energy consumption, and use of renewable energy sources)
- No matter how efficient a highway is planned, it serves as a barrier in terms of ecology and habitat → sustainability in a non-sustainable environment → additional efforts were taken to **encourage connectivity and avoid interrupting natural flows**
- Donating obsolete materials; plastics and other asphaltic material to local communities → low-impact, low-traffic volume infrastructures
- **Training** to assess the sustainable market chain and implement sustainability practices in the workspace and **courses** that teach team-building techniques are taught to managers and supervisors

- The project's sustainability policy focuses on monitoring and **low impact** to the ecosystem → 3 environmental initiatives focusing on:
    - reforestation and vegetation rescue
    - soil rescue
    - reestablishing migratory connections of the fauna, especially the Jaguar
- Sustainability manuals and procedures for environmental and workplace actions have been published → **goals are being worked on or achieved**
- A series of visual aids and workshops to ensure a successful implementation in the broader community
- **Comprehensive community assessment** that included interviews and visits to communities affected by the project (in 2010)

Management

- Focus of developing the **economic growth** and **accessibility** of its focus: Cancun and Playa del Carmen.
- Economic driver → **consolidating and linking commercial and tourist**ic corridors in
- Internal systems focus that emphasizes **ecological connectivity and low i**mpact on the regional habitat system.

Planning

- An **online monitoring system** that will capture **evidence from wildlife** and other sensing data placed along the site & a **management plan** that will address the **drainage systems** no less than two times per year → submit overall operation reports annually or by governmental request
- To achieve all the operation and maintenance goals: **annual professional growth schedule** that consists on training and other educational tools – budget allocation
- Regulations and policies with which they are required to abide

Resource Allocation

Materials

- 80.3% of the total project operates with the **use of recycled** bases that exists as support of the highway
- The asphalt that is taken from the existing highway is being **donated** to communities who request it for their own infrastructure works, other materials like signs and barriers are also being reused.
- Another initiative is to use **organic matter** from the Valladolid toll plaza as compost to be used for the landscaping of the highways
- Additional **soil rescue** program that seeks to limit the impact of the project on the site → All the soil (or at least 95% percent) will be banked to the right of the lanes, in nurseries, or in areas lacking vegetation and that have very little slope, at least 60% of it will be covered with organic matter to nourish biological processes and prevent erosion, some of these soils will be transported to the Agua Azul community to the flora rescue nursery

- Use of regional materials as a positive impact on the region. Included within the description is the explosion of local markets due to the scale and magnitude of the project, 83 out of 127 materials used are sourced locally

Energy

- All offices and toll plazas are equipped with high efficiency lamps, the lamps post in the highway have been equipped with individual PV cells → 2.91% **reduction in energy consumption**

Water

- Project is located in the karstic region of the peninsula → annual **plan** to monitor the **quality of the water**, especially after the end of the rainy season.
- Water heightened at any moment that a negative impact (spill, leak, etc.) is recorded, drainage system monitoring/cleaning procedure has been established (twice a year)

Natural World

Siting

- The highway project creates a **buffer** of 380m from aquifers in order to protect the cenotes and other important feature of the subterranean aquifer ecosystem (planted with regional flora to protect sites from excess heaving of sediments)
- The project has a **rescue and reforestation** initiative: maps that delineate the location of the new plants, nurseries etc.
- Lists of **native flora** were used in the project as a mean to promote the sustainability of both the rescue and reforestation programs and site landscaping
- The project has a **soil rescue program** that will and a policy that disturbed soils will be reutilized in the site to remediate areas suffering from desertification due to the loss of nutrients or topsoil
- The project diagrams and maps **natural corridors** for different species and create underpasses so that they are not affected by the highway system → increase the area of prime habitat, or distributed connections
- In an attempt to protect the **wetlands and the waters** that permeate through the limestone, the Project makes a conscious effort to avoid “humedales” (PSF From km 106+220 to 106+300) or wetlands or raises the structures that will be affected by these zones → project design was changed to avoid the wetlands for both environmental and structural reasons, measures have been taken to limit the impact on surface water, its flows, and the natural filtration properties of the karst region, which is the main rock type of the area → 12 evaluation stations
- **Drainage systems** can be used by the many amphibian species and other aquatic fauna to travel from one habitat to another

Land & Water

- A conserving assessment was possible because the project has adopted **zero pesticide and fertilizer policy** (indigenous plants do not require special needs of protection and nourishment)
- The project has limited impact on surface and groundwater ecosystems because the low stress design.
- The highway serves as a **path of least resistance** because the slope of the throughway responds to the natural slope of the terrain.
- To further protect the hydrological ecosystem, the highway will be coated with ABtotal, a polymer which absorbs hydrocarbons and oils and makes them inert.
- **Measures** include: Prohibit the dumping of liquid and solid residues in the river and surrounding areas.
    - Specific Areas designated for dangerous materials, special areas for washing the trucks handling concretes have been established
    - Install appropriate drainage systems following industry standards
    - Minimize interference of the flows of surface and groundwater
    - Refueling machinery outside of specified areas is not approved. If refueling is in situ, then the site for refueling has to be prepared.

Biodiversity

- The main project's threat is by the barrier and border effects that the highway has in **the prime habitats, including deforestation due to construction** → surveillance and monitoring devices to identify areas of species concentration
- Identification of Illegal hunting grounds, places of feline activity concentration and catalog an index of species and quantity of animals run-over, the team also identified **migration patterns and natural connections** and created a series of underpasses that would reinforce these trends
- The installation of **underpasses and open drainage systems** in wetlands mitigates the effects of the barrier and border effects that highways usually have on ecosystems → the number of trampled fauna decreases.
- Proactive stance and promotion of education and policing that would see an end to these activities (monitoring population numbers, illegal fur traffic and hunting) and elimination of other threats
- **Habit and forest rescue plan:** habitat restoration in a proportion of 3:1 reforestation (3 trees should be put in place for every one that is cut down, endemic species: greater survival rate)
- **Initiative to rescue and restore all the soils** as part of habitat restoration programs, processes and plans for the excavation of these soils have been delineated
- For example, soils will be banked to the right of the lane during site preparation. To prevent compaction, erosion, and nutrient deterioration they will be covered with organic matter. →This will start biological processes that could have been lost in the process of site preparation.

Climate & Risk

Emissions

(lack of documentation)

- Vehicles were inspected and were compliant with local laws

Resilience

- The **project design takes into consideration the climate threats**, and designs around them and to **prevent** them:
    - To eliminate the risk of structures failing under constant **flooding** and protect the ecosystem from traffic, one segment of the highway was redesigned to avoid wetlands and floodable areas
    - To prevent the extensive **erosion**, heat islands, and heat waves, the project team has adopted a 3:1 reforestation ratio, is planting the slopes that the bases of the roads create, and is planting the service islands with native plants
    - Several strategies to limit impact on the **karst region**, the underground basins, and open-air basins
    - To eliminate **short term hazards** of loss of habitat and erosion are addressed by creating nursery and reforestation programs
    - Measure for **short-term preparedness** is the storage of water
    - Delineation of **man-made hazards** during the construction and operation phases and categorization based on their risk magnitude and impact intensity

2. Parque Eolico Dominica, Mexico

Dominica is a wind farm located in San Luis Potosi, Mexico, and built in two stages (I and II), completed in 2014 and 2015, respectively. With an installed capacity of 200 MW and an estimated annual production of 260 GWh, the wind farm avoids over 303,000 tons of carbon dioxide (CO2), the equivalent of taking 64,000 cars off the road. The project represents an investment of 346 million dollars and has generated more than 600 jobs during the construction stage, with 40% of the staff being local.
The sponsor, Dominica Energia Limpia, a subsidiary of Enel Green Power México, developed a plan to preserve local habitat and promoted social programs to empower nearby communities through farming and reforestation workshops, as well as training on how to feed cattle during periods of drought. The project also improved community infrastructure, building sport facilities in two local schools and installing solar panels in the area.

In order to receive the Infrastructure 360° Award in this category, a project must demonstrate strong sustainability practices with an emphasis on climate change and the environment. Its contribution to diversity Mexico´s energy matrix as well as its innovative solutions to preserve local biodiversity and involve surrounding communities make Dominica a worthy recipient of the 2015 Infrastructure 360° Climate and Environment Award.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Overall

- Great understanding of community development projects by implementing them with outside-the-box thinking
- Delicate care of the region's fauna and flora with a combination of equitable programs, showing innovative ways in which a wind farm can transform communities through its overarching sets of context-driven community plans
- Sustainability goals achieved in all areas (material usage, energy, water, and other key areas)
- One area that needs improvement is in conducting interviews to learn how the wind farm affects the community. More rigorous studies and participatory feedback loops could improve the ways in which the community perceives the infrastructure and its effects on their day-to-day lives.

Quality of life

Purpose

- Attempts to enhance the lives of the residents through equitable community programs (e.g. Una Mano para la Vida, Molinos de Maguey etc.)
    - Una Mano para la Vida → communal innovation in food variety & food security
    - Molinos de Maguey → food security & increasing employment opportunities
    - Cacti for sale/to be planted for reforestation projects → environmental restoration
- Project: holistic and assessed community needs through a macro lens, thus enhancing community goals and better meeting their needs
- High score in this category because: it used stakeholder engagement with local NGOs to involve local vulnerable residents in the projects, alternative income source, upgraded infrastructure in 2 schools of the area, donations of solar power transformers after the completion of the project

Well-being

- Careful relocation of the flora and fauna to standards above the pre-project baseline that could otherwise have been destroyed

Community

- Holistic relationship between this large infrastructure project and its impacts on flora and fauna through the removal and replanting of different species in the area
    - Relocation of endangered flora and fauna → Good balance between energy production and ecological protection
    - Restoration by conducting detailed analyses → improve overall ecosystem

- Upgraded highway and conduct road improvements
- Upgraded infrastructure in 2 schools of the area
- The site exists on or near a place of archaeological interest; the wind farm was given explicit permission to construct on the site, with the requirement that it report finding any fossils during excavation of the site, stopping construction until the fossils could be removed to INAH for safety, if necessary. This requirement was successfully met, and in many cases obligated the project to complete the installation with industry standards being met. → Preserve the cultural heritage of the region

Leadership

Collaboration

- They created a shared value plan for US $200,000 and partnered with CONAFOR and SEMARNAT (national---level stakeholders) to identify needs at the national level, while consulting with landowners and the Wirikuta indigenous communities to come up with a set of programs designed to help them achieve the triple bottom line → high level of organization, coordination, and collaboration among national, state and local stakeholders as well as within EGP's international and national management operations → holistic, long-term view of the impact of the project

Management

- The project took into account infrastructure integration by identifying opportunities for improvement in the community through local stakeholder engagement processes (A private foundation is registered to allocate US $200,000 to the community and prepare for any unforeseen infrastructure developments that could benefit the community)

Planning

- The project team conducted a thorough review of Mexican Laws and regulations and found ways to follow these while maintaining EGP's standards, which are outlined in the company's sustainability protocols. The latter are stringent, and follow the industry norm of establishing best sustainable principles
- Conducted above-average planning, creating a system to streamline monitoring with ways to extend the useful life of the project
- Planning within a very top-down, hierarchical structure, following health and safety, monitoring, and quality assurance protocols written by EGP headquarters
- The project management has conducted feasibility studies to identify long-term areas where there may be need for further maintenance and potential cost savings

Resource Allocation

EGP subcontracted Gamesa to design, manufacture, and install the wind turbines at Dominica I and II while also operating and maintaining the turbines afterward.

Materials

- According to the supplier, the materials have longer durability and flexibility, life cycle analysis

Energy

- The energy required for the operation of the wind farm through photovoltaic plants located on the project site (+third party monitoring process by Gamesa)
- This project is identified as a net positive renewable energy generator due to the nature of the facility
- Checklist to monitor the energy outputs and identify any energy leaks to make sure the energy outputs are consistent.

Water

- The project team uses less than 5% of the water available in the area, keeping its demand for this scarce resource at a minimum but not showing any additional strategies for gray water use through water-harvesting practices

Natural World

Siting

- The choice of the site was based on an analysis of the area's land uses in combination with finding a location within Mexico where the winds blow strong and the energy is needed
- The project had to be proximity to the national grid
- Soil: dry and desert like
- Comply with national regulations: relocate fauna & flora
- This new infrastructure remediates the area's decreasing land value; the area depends mainly on mining – depleted and overused land
- Decreased the potential for bird collision due to advanced technology wind turbines and project site

Land & Water

- Used water management plans to decrease risks of contaminants leaking from the site into the water systems around the project site as well as the effects of the dust on hydrological studies
- Best-practice solid restoration plan to use the soil excavated for the turbine installations for the dirt roads used by heavy trucks in the construction phase

- In terms of spillage and waste removal plans, the project has a very rigorous set of plans that minimize the risk of chemicals spilling. All liquids and chemicals are contained, isolated, and disposed of in preplanned waste disposal containers.
- The project follows best practices that avoid pollutants that would affect the community's health and the environment's biodiversity

Biodiversity

- Environmental assessments such as hydrological studies of the surrounding watershed
- The project mitigates any potential deleterious effects on the Priority Hydrological Zone through good design
- Exceed national regulations through the program of fauna rescue and relocation program (animals that were rescued were placed in habitat similar to where they were originally found or naturally should belong – according to plants and feeding habits)

Climate & Risk

Emissions

- Reduces air pollutant emissions in both operation and construction phases and displaces demand for fossil fuels by using renewable energy

Resilience

- Each risk has a manual and training to effectively prepare to manage the potential risk scenarios
- Climate threats not analyzed and incorporated in the project design

3. Planta de Concentración Solar Cerro Dominador, Chile

The Cerro Dominador solar-thermal plant is currently under construction in the Atacama Desert, Chile, and will generate electricity 24 hours a day, becoming the first non-conventional renewable energy source serving as a base load for the grid. The plant has a 700-hectare solar field with 10,600 heliostats (a set of mirrors on a flat structure), each with 140 square meters of reflective surface. Heliostats track the sun concentrating solar power at the receiver which is placed at a tower that is 220 meters in height. The heat concentrated at this point is transferred to molten salt that will create steam used to drive a 110 MW turbine. To generate electricity 24 hours a day, the plant will use a pioneering thermal storage system developed that enables energy production for 18 hours at full capacity. This capacity gives the installation a high level of dispatchability, adapting production to the needs of the grid.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of life

Purpose

- During the construction phase Abengoa will build a camp with the capacity for up to 700 people, this facility will provide all the services required solving at the same time other issues such as **transportation** to the site
- **PLACEDO – a community development plan**, setting the guidelines for strengthening civil society, recovering **historical heritage**, culture, recreation, education, and health
- **Collaborative approach**: participation of several stakeholders and authorities has been encouraged from the beginning of the process → dialogue, promotion of innovation & territorial participation
- Introduction of more than **2.000 employments** in the construction phase, 60 people will be hired for operation
- **Training** from the project stuff to all employees covering all topics of environmental aspects
- Abengoa will provide technical support and a 6-month margin to implement the emissions account in the company procedures → increasing long-term competitiveness of local companies
- Scholarships for recent graduates to work in a facility of Abengoa Int., Bachelor's degree offered in solar energy and short term courses in concentration solar plants → promotion of studies and research → build local capacities and technology transfer towards a more sustainable Chile
- **Outstanding performance on long-term capacitation, scientific knowledge and human capital development → innovative point**
- The programs proposed are "Associative Chilean Universities Program for Training Futures Professionals and Specialists in Solar Technology", "Collaboration Agreement UTFSM and Focus Abengoa","Fundacion Chile" Agreement, "Cooperation Program with Universities and Research Centers National for Knowledge Transfer".

Well-being

- The preservation of historical and cultural resources, as well as the conservation of local character is discussed through archaeological implementations and landscape assessments
- Discoveries: exploitive mining residues of the 19th century
- Voluntary commitment for developing scientific publications (historical study and spatial analysis for elements in the project area) → dissemination of studies focused on industrial heritage and historical link to exploitation of saltpeter
- Landscape assessment analyzing the impacts on the landscape and local character integrity prior to project
- Alterations to landscape due to previous mining activities, added power lines, renovated pathways

- No obstruct visibility on areas of importance, no interference with local character, no effects to touristic value

Community

- Calculation of noise control during construction phase → met regulatory limits
- Workers receive fundamental training, yearly safety protocol simulation, and ongoing instructional support from the construction company
- Emergency plan guide in projects's website
- Security system to detect and prevent any type of risks
- One of the highlighting factor of the project is the **convenient site accessibility** through preexisting road infrastructure, mobility and access to the site were taken into great consideration, incorporating the construction of camp housing for 700 workers on site
- Improvements for accessibility
    - private bus transportation for workers
    - improvement of non-unpaved paths between the facility and main roads
    - internal accessibility with
    - signaling and safety systems to roads accessing different parts of the plant

Leadership

Collaboration

- Environmental responsibilities carefully assigned to the different members of the project team & revision of responsibilities when needed → Environmental Management Plan & control mechanisms
- Target goals:
    - Creation of a sustainable region by promoting efficient management of waste
    - Enforce environmental liabilities arising from economic activity & enforcing specialized regulations
    - Support employment development
- Comprehensive planning in all stages of the project (construction, maintenance, operation and dismantling)
- Detailed analysis on the Maria – Elena community → identify community needs, more effective engagement process
- CSR report – project strategy:
    - Stakeholder involvement
    - Incorporation of communication channels
    - Community relation building activities

Management

- The project is planning to use an existing transmission line to connect the facility to the grid → perfect linkage between new and existing infrastructure
- Very detailed fieldwork: landscape, vegetation, wildlife, archaeology

- Enhance local transportation

Planning

(Long-term monitoring and maintenance had not been yet recorded because of the early phase of the project)

- Plan for addressing conflicting regulations and policies & extend useful life in all aspects
- Regulation verification to reduce project risks
- Economic and technical assessment after useful life expiration →feasibility of the material renewability → extension of project's life for up to 20 years

Resource Allocation

Materials

- Strong program for sustainable procurement with special focus to GHG calculation → all suppliers are required to implement this practice & account and report GHG to Abengoa
- Regarding used recycled materials: main focus of the waste management plan is to use recycled materials in the construction of the project → Sustainable management program, reduce virgin materials and minimize landfilling, at least 60% of the materials used are locally sourced
- Efforts to divert materials from landfills:
    - Perform segregation at source
    - Reuse & recycle
    - Disposal at approved sites
    - Optimization of the use of water (effluent of treatment plant used to wet road activities)

→ These initiatives will reduce the waste disposal by 50%

- Most of excavated materials will be used onsite for various purposes
- Dismantling phase: In each of the activities of the closure phase only materials that cannot be reused or recycled will be sent to a landfill

Energy

- The high efficiency plant includes several tanks of high temperature salt storage which produces electricity for up to 24 hours
- The project will generate net positive energy it is divided into 2 different facilities each of them supplying a capacity of 110MW of renewable energy
- Several test before the operation phase are going to be conducted
- It is expected that a detailed plan with a third commission party will measure and document the efficiency of the electrical and mechanical systems implemented on the facility, guaranteeing the best performance.

Water

- Assessment for the extraction of freshwater → effort to generate decrease on the dependence on water availability
- Drinking and industrial water will be supplied by external suppliers since there is no fresh water available on project site
- Reutilization of water for specific tasks
- 70% from the wastewater will be treated in a wastewater plant and the rest will be handled in chemical baths
- Water treatment plant for potable water production
- There will be no recharges into the water bodies, a control program for monitoring spills of dangerous substances into streams will be conducted

Natural World

Siting

- Low risk and disturbance in its isolated area (15km apart from closest residential communities)
- Desert environment, therefore the soil is considered to have no ecological value for forestry and farming purposes
- A river located near the project is identified as non-impacted by the project
- Detailed geotechnical study: This allowed the opportunity to locate the project in a safe area with no adverse geology associated
- Drainage system in order not to affect the infiltration of the soil, free drainage of rainwater
- Area with strong industrial, mining development, saltpeter extraction, existence of transmission lines → lower quality

Land & water

- Custom system to capture and regulate storm water, free drainage of rainwater
- No vegetation required to be treated therefore no use of pesticides and fertilizers is needed
- Detailed assessment for the groundwater contamination is conducted, the stored quantities of chemicals that will be used in the facility comply with current regulations
- Other protocols such as the decanting process of the wastewater coming from the concrete plant were implemented from early stages.
- Initiatives to prevent water spillovers that could create groundwater and surface water contamination

Biodiversity

- Prevention of species diversity:
    - Detailed study to identify the flora and fauna of the area

    - The project will not have negative effect on the native flora, no major evidences of fauna have been found
    - Training to employees to sensitize them to biodiversity aspects, hunting ban, response protocols in case biodiversity is affected
- Control of invasive species
    - No invasive species have been identified in the area
- Restoration of disturbed soil
    - Help bring land to its natural state prior to development
    - After the completion of construction several measures are going to take place to guarantee restoration

Climate and Risk

Emissions

- Will greatly reduce GHG emissions
- Calculate the emissions generated as part of the GHG inventory of the company
- Following local regulations and good practices
- Up to 24 hours' generation of energy and reduce of air pollutants
- Reduce the NOx emissions with an efficiency of 99.5%
- Estimated emissions do not significantly affect the environment

Resilience

- Abengoa analyses in detail the risk that climate change could cause in certain typologies of infrastructure
- Projection of temperature rise and changes in precipitation: focus in this kind of plants
- Country's growing demand in electricity & water scarcity:
    - High efficiency method to reduce water for energy production
- Water treatment plant will treat 70% of the wastewater
- Reuse and recycle of water
- Sewage and industrial water will be handled accordingly

→ Reduce vulnerabilities associated with scarcity

- Adaptability for long-term scenarios
- **Innovation Point:** measure of the direct and indirect GHG emissions to estimate carbon footprint
- Subcontractors will have a 6 month window to implement the methodology, termination of contract in case of no implementation

4. Moquegua Solar PV Plant

Moquegua is a solar photovoltaic plant located in the remote arid region of the Moquegua Department, southern Peru. The plant produces 16 MW of energy through polycrystalline silicon PV solar panels distributed around 134.4 hectares, utilizing the region's ideal solar radiation levels, which allows the plant to generate electricity up to 10 hours a day and operate all year round. The PV plant avoids around 31,000 tons of carbon dioxide (CO_2) annually as well as the

use of water for energy generation in a region where annual precipitation levels average 300 mm. Moquegua was built and is operated as a 25-year concession by Moquegua FV S.A.C., a subsidiary of Solarpack of Spain. Ardian Infrastructure bought 81% of project shares in 2016, but Solarpack remained responsible for operating the project. The total investment for the implementation of the project is estimated at $42.8 million.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- The photovoltaic plant will inject energy to the Peruvian national network using a process that does not require the burning of fossil fuels, it does not generate noxious emissions of the use of water
- The project will protect the country's hydric resources and improve the quality of life of the citizens of Moquegua and Peru in general
- The plant will engage with the people living in the surrounding settlements by educating them on the benefits of solar power and by organizing tours to the plant once every six months. These groups will be able to interact with the plant using mailboxes that will be installed both in the plant and in a nearby municipal building
- During construction, 130 jobs will be needed and 80% of them are for workers with no qualification, prioritization to local workers

Well-being

- No archaeological remains in the area, making periodical analysis once a month, keeping an archaeologist on the site to make sure that there are no archaeological remains

To reduce any negative impact to the environment: the project will paint some of its elements in colors that will merge with the tones of the surrounding landscape

Community

- Inclusion of contractors and workers who work towards improving the plant safety
- Periodic noise monitoring studies conducted every three months
- Efforts to reduce the amount of light features used
- Utilization of materials and building typologies found in the region and create visual barriers with the use of natural elements

Leadership

Collaboration

- A system management oriented towards sustainability with high levels of the organization embedded in the structure
- Many of the tasks needed to achieve the desired sustainability levels will be performed by a third party contractors
- Special attention in communicating and incorporating into Moquegua view on sustainability → sustainability manager on site
- The company intends to interact with all different stakeholders by having meetings once every three months → receive feedback that can improve the design, taking into consideration the characteristics, needs and limitations the participants might have

Management

- A very positive coordination between the two plants on infrastructure integration
- Moquegua PV plant will share the access road with Panamericana Solar 20TS an initiative that not only helps the plant reduce its costs, but also reduces the surface area that has to be compacted and treated to allow for vehicular transit.
- Moquegua also will use some of the neighboring plant's infrastructure to inject its power into the national grid
- Moquegua FV has identified the elements and materials that will be discarded and has identified some of them as eligible for reuse

Planning

- The company indicates that with adequate maintenance they can extend the life of the solar panels 5 to 10 years
- Plans to reuse some of the equipment of the plant on a different location

Resource Allocation

Materials

- **The project is using manufactured products from at least two providers; both certified by third parties as incorporating sustainable practices into their procedures**
- Has identified amounts of waste that will be produced during the phase of construction and has developed a plan to deal with the waste, 37% will be recycled
- Positive efforts to reduce the excavated materials taken off site, only 44,931 out of the 942,317.18 excavated cubic meters are not going to be used in other parts of the plant

Energy

- The project excelled in this category by reducing the energy consumed up to the point that it produces more energy than it needs

- The plant will generate energy using photovoltaic panels a technology that does not require the use of fossil fuels or water to produce energy
- During operations, the plant will be self-efficient consuming part of the energy it produces and injecting the rest to the Peruvian national network

Water

- The plant has estimated the amount of water that will be used and calculations have been made to determine the amount that it will need for operation and construction

Natural World

Siting

- The plant is located on a very isolated location more than 10 kilometers away from the nearest urban area and approximately 40 kilometers away from the closest city, it does not have community in its closest vicinity
- Far away from protected ecological sites → the plant does not need to create buffer zones

Land & water

- Arid land with 30mm precipitation on average per year → The plant keeps most of the surface unpaved – a feature that will help the soil absorb water
- The project aims to eliminate the amount of fertilizers and pesticides to 0 → sustainability feature that minimizes ground and water contamination
- The plant prevents water contamination with features that can contain possible leaks and spills that might contaminate the soil and water in the area inside the storage areas
- A spill and leak detention policy has been designed to control possible contamination in other areas of the plant

Biodiversity

- Study of the species that could be found in the area and its conservation status → recognition of the value of the local fauna and flora
- They did not include any invasive plant species into the project
- Planning for restoration of disturbed soils: the aim to restore the disturbed soils after construction and once the operation phase concludes
- They will remove soils polluted with fuels and lubricants; which is a positive strategy as it is important to try and restore the soil as close to its original conditions as possible

Climate and Risk

Emissions

- The plant emits carbon credits under the Kyoto Protocol Clean Development Mechanism to reducing 30,983 ton CO2/year
- It will contribute to diversification of the Peruvian energy matrix as well as displace electricity generation from thermal power plants which is expected to result in GHG emissions
- During operations, the plant will not use fossil fuels to generate electricity
- An improvement in the air quality is anticipated since it will indirectly push for reduction in the thermal power plants emission of local pollutants such as NOx, SOx and PM.

Resilience

- The project performed well in risk assessment and planning by information of a comprehensive list with potential risks → risks analyzed into 11 categories

5. North Terminal at Port of Callao, Peru

APM Terminals is a division of the Danish A.P. Moller Maersk group, which designs and operates seaports and land terminals. In 2011, the company was granted the concession of Port of Callao's Northern Multipurpose Terminal, the biggest in the country and along the pacific west coast in South America. The Terminal was designed to manage the cargo trade and the general trade of metals, grains, fertilizers and chemicals, carbon, vegetables, fish oil, and heavy machinery. The modernization plan for the Terminal consists of 5 stages of construction that will be developed throughout the next ten years, representing a total investment of $750 million. When the construction work is complete, the infrastructure in place will be able to manage up to 3 million TEU's and 15 million tons of general cargo. Along with the modernization project of the Terminal Norte, APM Terminals is also developing various grassroots community-based programs, such as the breakfast donations for children from Callao, the refurbishing of the fishing loading dock, and the implementation of immediate response stations in collaboration with the national police from Peru in order to increase security in the zone.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Creation of new jobs and expansion of the socio-economic opportunities for the community by implementing social programs
- **Growth and development**: Local employment and working opportunities to ensure maximum resident involvement in the project area of influence

- Courses in the in-house Training Center → training for new personnel and developing skills through technical studies
- **Social programs:** in detail identification of the direct and indirect area of influence, mapping of relevant groups within the community
    - Intensive program of social responsibility: inclusion of surrounding communities
    - 3 key areas: education, health and infrastructure
    - around 20 were implemented
    - company is focused on performing port's operation with minimal environmental impact

Well-being

- The design of the buildings and constructions related to the port modernization, were integrated to into the predominant industrial landscape creating a coherent aesthetic by merging the new building with the old ones

Community

- **Safety** as an integral part of the planning process
- In terms of **security**: a very strong program in its premises including new technologies offering new standards of security
- Integration of new methodologies and campaigns in order to achieve their goal of zero accidents and fatalities
- **Health** support for all employees, annual health examinations and family insurance

Leadership

Collaboration

- The **management structure** integrates different instances of participation and collaboration to gather the opinions of all stakeholders involved, including the affected population, suppliers and contractors → key to achieve sustainability objectives of the project
- The **Annual Sustainability Report** demonstrates leadership and commitment to address economic, environmental and social goals of the project
- Various **strategies** to strengthen environmental management (monitoring of air quality, vibration, noise, seawater, marine sediments and biological evaluation of wildlife in the area of direct influence)
- Project to improve the quality of life of the artisanal fishermen of the area, support to the ongoing efforts of sustainability beyond the scope of the project
- Social program aiming to generate a process for partnership and networking with stakeholders in order to support local sustainable development
- Broad involvement and communication with all stakeholder groups

Management

- **Infrastructure integration**: project team able to integrate the old city's existing infrastructure with the port → long-term sustainable aims
- **Solid Waste Management Plan**: wood and metals waste → segregated and marketed by authorized companies (approx. 236 tons of waste recycled in 2013)

Planning

- The modernized port has been designed to last at least 50 years and is expected to last for 100 years → taken into account strategies required for current operation and beyond
- Acquisition of the largest and most modern crane for long-term operation → expended functionality
- The design of the port considered expansion and reconfiguration → possibility of future changes in use or capacity
- Security programs, constant inspections and equipment maintenance schedule → ensure that design performance and overall port activities will be maintained throughout the life span of the project

Resource Allocation

Materials

- Strong set of design specifications for land restoration, waste management, recycling and use of regional materials in order to support sustainability aims
- **Waste Management Plan** developed by a third party: analysis of waste generation, collection according to classification of waste, disposal according to classification, special treatment for dangerous and toxic waste
- Training for all construction workers
- High level of achievement in the recycling of materials verified by a third party
- Procurement practices and use of local materials: innovative system entitled E-auctions for materials and equipment purchases → transparent and efficient transactions, Callao: regional leader in electronic and open procurement practices

Energy

- Callao is one of the global leaders in promoting the use of renewable energy sources in port operations
- Implementation of a new generation of port terminal cargo handling equipment, substituting previous diesel equipment and reducing energy consumption during operation and maintenance → aim not only efficient energy use but reduction of overall operation and maintenance costs throughout the project life cycle
- Implementation of energy systems monitor in each port terminal cargo & third party commissioning supervision

Water

- Implementation of a program to train employees to reduce the overall water consumption

Natural World

Siting

- The project aimed to expand and improve old port facilities avoiding a new project on additional land → supporting the preservation of prime habitat by infilling already developed land rather than producing an additional ecological footprint on virgin lands
- A third party study on environmental impact evaluation and activities demonstrates that no areas of prime habitat are located on-site or within the specified distance of development according to environmental law
- Expansion and improvement of the old port facilities do not have a negative impact on the vegetation and soil protection zone, no adverse ecological formation

Land & water

- A brownfield and remediation plan was carried out during the construction phase preventing future water contamination by cleaning up previously contaminated land, restoring wellhead protection and installing land use controls to prevent future contamination
- Environmental Impact Evaluation and activities study & Stormwater study: there is no significant impact on runoff quantity and quality

Biodiversity

(Lack of evidence)

Climate and Risk

Emissions

- In a port terminal the key to reduce emissions is the cargo handling process, the new generation equipment implemented work on electric energy substituting previous diesel equipment → carbon monoxide, nitrogen dioxide and ozone reductions
- New underground system to transport grain and other goods → further reducing emissions

Resilience

- Natural hazards emergency plan & third party assessment covering certain climate threat issues (e.g. risk of lying coastal areas as tsunami susceptible)
- Chemicals management plan: list of likely natural hazards for the next 25 years

- Risk management and action in case of emergency in order to prevent damage and contamination mainly to the ocean

6. Santo Antônio Hydropower Plant, Brazil

Santo Antônio Energy is the company responsible for the implementation and operation of the Santo Antônio hydroelectric plant located on the Madeira River, seven kilometers from Porto Velho (RO), in Brazil. The project began generating power on March 30, 2012, nine months ahead of the original schedule, with two of the 50 bulb turbines already in operation. The turbines are installed horizontally and work with the force of the current. For this reason, there is no need for high dams and storage reservoirs. In the case of hydroelectric Santo Antônio plant, the reservoir has a size of 421 square kilometers, which means that the tank is three times smaller than it would be if it had a different type of turbine. The concession period is for 35 years and the dam's installed capacity reaches 3,566.40 megawatts (MW), enough to supply more than 44 million people. The total investment for the implementation of hydropower is estimated at $19 billion, of which $2 billion is invested in sustainability.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Significant influx of sustainable energy to Brazil, diversifying its energy source matrix and enhancing its competitiveness of Rondonia state
- Stimulating local development as it provides and expanded supply in increase in quality and reliable electric energy
- Once it operates in full power it will supply the state with an average of 600 MW by 2016 & gradual disconnection of traditional thermoelectric plants
- Improvements to local productivity: provision of electrical energy & advances in integration with other localities → promotion of new business & attraction of capital
- The area considered for impact mitigation was strictly limited to what the Brazilian Institute of Environment & Renewable Resources references as the Area if Direct Influence delimitation for hydroelectric plants
- Many riverine communities were displaced → Compensation and new housing for 540 families (2,044 people)
- The resettled families agreed to relocation since they have acquired an area with the possibility of generating income, basic infrastructure services and the benefit of regularized tenure of land ownership
- The project team is trying to mitigating population relocation by implementing several measures
- New jobs for the area (at peak phase 20.000 jobs, 80% filled with locals)

- Training to more than 40.000 people of the community
- Public meetings,
- The project does not affect indigenous populations
- Cooperation in conjunction with Brazilian FUNAI for the indigenous communities & development of social and environmental programs
- Developing local skills and capabilities: special attention to the needs of the locals, indigenous communities and women (women working during construction: 10% and participation in educational program)

Well-being

- Steps to identify, preserve and restore cultural resources according to the programs created related to the archaeological, prehistoric and historic heritage of the area and in compliance with Brazilian regulations
- Field reports, delimitation and rescue of the archaeological sites, technical training, curation, lab analysis, dissemination of results and seminars were carried out
- 58 archaeological sites, 157 archaeological occurrences → identified
- Public space enhancement: the team prioritized the improvement of existing public space, creating parks, public venues, sport facilities, cultural centers and wildlife viewing areas

Community

- Enhancement of public health & safety: reduction in frequency rates of injuries and accidents during construction
- Public health development: they improved their own health and safety standards above regulation requirements, they won the 6th Medical Services Innovation Award
- Mobility & access: Supporting and investing the mobility plan of Puerto Velho Urban Mobility Plan (PMob)
- This investment is part of an agreement signed with the city of Porto Velho to integrate the social compensation program with the implementation of the Santo Antonio Hydroelectric
- Providing onsite wayfinding following the guidelines and requirements set

Leadership

Collaboration

- The team is providing effective leadership and commitment to improve sustainable performance by adopting the Equator Principles: financial industry benchmark for determining, assessing and managing environmental and social risks in projects & audit
- The project's management system prioritizes avoiding processes that can trigger environmental degradation in the area of direct influence → environmental criteria and procedures in agreements with construction companies & subcontractors
- 28 environmental mitigation programs

- The project performed well in terms of teamwork, consultation, communication with stakeholders and participation of the affected parties
- Comprehensive stakeholder involvement: the team held a participatory process which attracted more than 2.000 people to 64 meetings, and six public hearings
- Stakeholder engagement at the initial project phases → debate the results before public hearings started
- Environmental impact assessment in conjunction with local universities
- Stakeholder groups: a) riparian population in the power station area and the resident population downstream the projects, b) indigenous people, c) urban population of Porto Velho: academic communities, students, industrial and commercial business, representatives from worker union/entities, d) government constituents, and e) communication and press agencies

Management

- Program to support the reuse of unwanted by-products in order to reduce waste, improve the project's performance and reduce costs
- Infrastructure integration: improves integration by taking into account the operational relationships with the community and providing energy to the northern region of Brazil – estimated to provide power to 45 million people

Planning

- Comprehensive maintenance and monitoring plan has been prepared in advance to the project's completion
- The team incorporates useful life cycle thinking in improving the durability, flexibility and resilience of the project over its projected lifespan
- In order to expand the plant's useful life, the team developed a hydro-sediment monitoring program which according to the predicted parameters, it will extend its lifespan for 100 years

Resource Allocation

Materials

- In diverting waste from landfills:
    - At least 75% of the waste stream is recycled, reused or diverted from landfills
    - 88% of the waste generated at the construction site is intended for recycling
        - ➔ Goal to raise this percentage
- The team achieved an efficient waste management during construction against the lack of public waste infrastructure and management in the neighboring communities

Energy

- The project generates a significant net positive amount of renewable energy capable to give power to 45 million people with its installed capacity of 3586MW once completed

Water

- Total water management
- The team has taken special care in monitoring pollutants in the water – water quality monitored trimonthly

Natural World

Siting

- Exploration of the area → documentation of local species → contribution for natural sciences
- A small positive aspect about the deforestation for construction in its area is that it will provide access and opportunity to collect large numbers of botanical samples of great scientific value, which can be considered a small compensation considering the magnitude of the loss
- Technical assistance, land and monetary compensations were given directly to the resettlement families who had lost their plots for agriculture
- Avoiding adverse geology: the siting provides protection and risk management as it takes advantage of the rocky outcrops of the Sao Antonio falls to construct the dam
- Although the project does alter the floodplain functions, the project team tried to mitigate impacts with various compensatory programs
- The team follows best management practices to manage erosion and prevent landslides by delineating mitigation in the hydrosedimentological monitoring program

Land & water

- There are water quality monitoring programs conducted by the project team
- There is intent in reducing pesticide and fertilizer impacts with application management practice
- Surface and groundwater contamination: several environmental programs including long-term monitoring of surface and groundwater have been implemented → to reduce impacts caused by the construction and operation stages
- Comprehensive monitoring program → to prevent contamination of the water

Biodiversity

- Biodiversity can be preserved through comprehensive mitigation strategies during and post construction of the dam
- There is intense work in rescuing the animals that inhabited the reservoir areas to ensure conservation and avoid impact on the local fauna
- Several mitigation and monitoring programs including fish and icthyofauna conservation program and wildlife protection and wildlife rescue program were implemented
- Use of appropriate non-invasive species → elimination of invasive species & control of exotic species

- Plant nurseries were establish during deforestation phase
- Restoring disturbed soils: various programs to restore soils and bring back its ecological and hydrological functions
- Wetland & surface waters: three functions addressed in the mitigation and monitoring program → hydrological connection, water quality and habitat

Innovation credit:

- Even new species were found while implementing the infrastructure
- Innovations in the industry: structural systems for mitigation and biodiversity preservation, the log interceptor program and the fish transposition system → contribution to the knowledge of the region of a great flora and fauna diversity → important scientific work with the contribution of local scientific community

Climate and Risk

Emissions

- The plant will generate low emissions electricity that will be delivered to the national power grid, displacing CO2 emissions generated from fossil fueled grid-generated electricity
- Annual emissions reduction estimation is 5,146,403 tons of CO2
- During projects concession the emissions reductions: 51,464,028 tons using 3,150.4 MW as installed capacity
- The Santo Antonio plant produces 8.5 megawatts per km²de reservoir
- Negligible air quality impact through their air pollutant emissions mitigation strategies

Resilience

- The team has taken steps to prepare for climate variation and natural hazards by monitoring climate and creating a database that can serve to create an impact assessment and adaptation plan
- Meteorological monitoring program implemented
- Short-term hazards: they have considered the types of natural and man-made hazards that are possible in the region and installed environmental monitoring programs

7. Tunjita Hydropower Plant, Colombia

The Hydropower Plant Tunjita, located in the municipality of Macanal in the department of Boyaca in Colombia, is a project designed to take advantage of the energy provided by deflected waters from the Tunjita River to the La Esmerelda reservoir, which stores the water used by the Chivor Hydropower Plant. Specifically, the water used flows through an existing 14-kilometer tunnel that allows for a 300 meter fall, generating 19.8 MW of renewable energy. With

a $67 million investment, the project has currently completed 88% of its construction and hopes to be operational by the end of the first semester of 2015. From the beginning, the project has tried to install the best technology, security, and protection of the environment. The project is registered at the "Clean Development Mechanism" in the Kyoto Protocol of the UN's Convention on climate change. Tunjita has made important contributions to neighborhood communities in terms of infrastructure education, environmental sanitation, mobility and training. The project has created over 400 new jobs and has brought significant resources to the local economy.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of life

Purpose

- Highly synergistic relationship with pre-existing AES Chivor assets, simple upgrades & installation of machine house → construction of the plant
- Reduces costs and construction timeline
- The National Grid extends to 1,5km within the site → minimal disruption of the forest cover
- Supplying energy to Colombia's National grid → national pride, altering energy matrix
- 500 new jobs to locals to upgrade the facilities
- ¾ of the total workforce derive from towns in the region
- AES Chivor Social Management Plant; The project is exceeding the Colombian government's millennium objectives
    - Educational opportunities for local communities
    - Facilitating local business development
    - Supporting the most vulnerable sectors of the population
    - Creating jobs

Well-being

- Creative reuse of excavated dirt: stacked and sculpted into a scenic overlook
- It is conceivable that this outlook would become a touristic attraction
- Following conclusion of construction activities → revegetation with indigenous plants → minimization of erosion and habitat restorations for dislocated fauna and flora -No fertilizer or pesticide use
- Minimal logging and construction → minimal disruption of the natural landscape & reduced project timeline
- Additional environmental safeguards (eg materials, recycling)

Community

- Minimal footprint: No indigenous or Afro-Colombian people reside near the project site

- Rural area, given primarily to pasture for grazing, and subsistence farming
- Diligent effort to include people from neighboring towns in the development process
- Meetings where community members weighed in on the development decisions and asked questions on how they would get affected were held, creation of a telephone hotline for questions and comments → community outreach, broad local support
- Strict safety and wellness protocols for the company and its primary contractor
- Efforts to minimize light and noise pollution and vibrations
- Enhancement of public spaces
- Community members can expect to benefit from the project from the short-term to the long-term

Leadership

Collaboration

- Project team has been soliciting and providing channels for stakeholder collaboration
- Stakeholder meetings with community being the primary audience
- On the governmental end, trimestral meetings are held with other public entities to ensure that regulators and officials have access to current and relevant information about the project
- AES Chivor has constructed their organization hierarchy integrating internal team members as well as representatives from their contractor and a Construction Management team → focus on collaboration procedure

Management

- Strong environmental leadership throughout the planning and construction phases
- Measures beyond what is required by law
- Systematic implementation of plans to reduce deforestation, noise pollution, overlighting and contractor overreach, Community outreach, hiring local labor → leadership credentials
- Public commitment to sustainability & intensive corporate responsibility imitative
- Emphasis on sustainability management systems

Planning

- Assurance of health and safety, environmental compliance → monthly meetings where progress is assessed and areas of improvement are identified
- Weekly reporting → progress recorded and tracked
- Frequent issuance of reports → dissemination of up-to date information
- Incentives to reward personnel diligent in maintaining full compliance
- Long-term monitoring and maintenance of the plant
- AES Chivor has a history of responsibly monitoring and upgrading their systems to increase the likelihood of an extended-life outcome for the project

Resource Allocation

Materials

- AES Chivor has systematically endeavored to acquire the most sustainable options available
- Special attention has been placed to the procurement practices of the primary contractor (ISO 14001 certified) → methodological approach t sustainable construction practices
- Use of recycled materials throughout the phases of the project (dirt and gravel reclaimed from excavation activities)
- Policies for the proper collection, storage, reuse/recycle or sale of waste on site
- Project support structures are designed to be dismantled and reused → longevity in mind

Energy

- Steps to reduce energy consumption during construction
- The plant will be a net renewable energy resource as soon as it comes online
- The plant will draw part of its energy to power itself, the remaining energy is going to be directed to the national power grid
- In total 110 GWh of energy is going to be produced per year

Water

- Hyper-local hydrological conditions have been monitored for the last 35 years → predictions of water conditions at Tunjita with a high degree of certainty, flow rates are consistently high in the area
- Policies to monitor and minimize water usage in the area during construction are in place
- It is expected to decrease water consumption by 5% from non-intervention levels
- Independent contractors have been retained to evaluate the performance of water management systems and water quality

Natural World

Siting

- The project site is not considered a prime habitat
- The vast majority of the land within the project site will remain undisturbed
- Preservation of the nearest forest
- Construction decision making has been base on the:
    - Environmental Management Plan
    - Evaluation of erosive activity and geological threats of the Chivor watershed
    - Evaluation of Geology, Geomorphology, and Chivor Facility Risk areas
    - Post-construction landscaping and revegetation of the adjacent land further enhances site performance under flooding conditions

Land & water

- Stormwater management has been a priority during the development process of the plant
- Excavation conducted with stormwater flow in mind → post-construction site to achieve better control flow
- 90% water storage/retention is expected
- No pesticides or fertilizers applied
- The project team ensures an effective response to spills and leaks

Biodiversity

- Identification and protection of natural habitat and biodiversity
- Landscaping and revegetation initiatives to be implemented upon construction completion
- Signage has been posted on nearby roads to warn motorists that they are entering a wildlife corridor, minimal traffic near the project site
- The habitat surround the dam will quickly be restored to pre-intervention levels
- Plant species to be plant are indigenous, invasive species control

Climate and Risk

Emissions

- The project contributes to GHG emissions reduction providing energy from renewable energy resources
- It is estimated that there will be an annual 32,000 tons of CO2 emissions
- Steps to reduce the project's carbon footprint during construction phase
- Construction activities comply with Colombia's air quality law

Resilience

- The project team has worked hand in hand with the local communities to create a comprehensive action plan that accounts for long-term costs and risks
- Meetings among residents and project team to discuss project visions and air concerns
- Project hotline → transparent communication and collaboration between stakeholders
- Latest contingency plan incorporating project risks & updated every 5 years to reflect the current landscape
- The team is prepared for one-in-50-years hazards
- Emergency and Environmental Contingency plans with threat specific response protocols
- Focus on safety guidelines

8. Aquapolo Water Sanitation Project, Brazil

The current water availability in the Metropolitan Region of São Paulo - the third largest urban agglomeration in the world- is 130,000 liters per inhabitant per year, offset by the pollution of rivers and the increasing civilian settlements developed at an unpredictable rate on the outskirts of existing water supplies. UN's recommended availability, however, is 2,500,000 liters per inhabitant per year. To increase water availability, Odebrecht and Sabest created the joint venture Aquapolo Ambiental to produce and supply high quality industrial water from the sewage collected in southeastern São Paulo to the Capuava Petrochemical Complex, the biggest consumer of potable water in the region of Sao Paulo. With a production capacity of 1,000 liters of recycled water per second, it is the largest wastewater project in the Southern hemisphere.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Supply the region with recycled water → positive impact to the community
- By producing potable water for the biggest consumer of the area – Petrochemical Center of Capuava, → redirection of fresh water from its use in industrial purposes to now supply the community
- 2,58 billion liters of potable water will be saved every month helping supply 500.000 inhabitants
- By providing a new source of water for industrial purposes, more similar business and industries will be attracted → economic development and growth of the area
- Hiring local companies and businesses & developing training programs for the community → improvement of community capacities
- Effort to keep the community involved: by promoting discussions, exhibitions, seminars, series of lectures in schools and cultural celebrations → educating locals on the rational use of water
- Planting awareness project: children planting trees
- Relocation of some facilities and network public services that used to be inside the site of the project → mitigation of project's impacts to the community

Well-being

- The project team ensures uninterrupted water supply to the community and promotes transparency
- The project is located in an urban area, therefore it needed to attend regulations regarding noise and vibrations standards → under the permissible levels
- Encourages alternative modes of transportation to and from the site of the project by reimbursing the workers' metro and bus fares

Community

- During the construction of Aquapolo, underground archeological remains were found, the project team hired a specialized agency to work with the national institute for historic and artistic heritage of the Brazilian government. A plan to safeguard the objects found in the history museum was implemented
- Visual impact: there is no direct visual connection with the surrounding neighborhoods
- Plan to build and restore previously existing facilities in both municipalities → public spaces enhancement
- Compensation to the population for the disturbances caused by the pipeline construction

Leadership

Collaboration

- The project team is composed of employees with broad range of professional backgrounds working in collaboration, specific positions were created to address environmental, health, safety and socio-environment issues
- Personnel trained for changing conditions
- Transparency and organization in the process of creating contracts → reliable transactions
- Environmental Insurance Certificate, Insurance of General Civil Responsibilities → set responsibilities in case of an environmental emergency
- Collaboration and coordination between team members → crucial to the success of the programs implemented

Management

- Aquapolo is a synergy opportunity itself since it reuses wastewater (sewage discharges) to generate a new source of water for industrial purposes
- Linkage between community and industry, Industry: new source of industrial water, community: redirection of potable water → significantly improved quality of life
- Internal synergy: return of the sludge produced during the recycling water process

Planning

- Monitoring plans (water supply, energy needs, amount of effluent received, water distribution and maintenance) are fundamental to the production of recycled water, thus they are present in almost every process of the Aquapolo plant
- Setting daily, monthly and yearly goals and objectives
- Management of the plant: long-term system that includes the goals and objectives of the plant for the next five years, reviewed every year to keep the company on track
- To extend the useful life of the project: different maintenance plans are implemented to preserve the equipment in working conditions and to ensure that it is being correctly used

- Project designed to provide more water than it currently does foreseeing possibility to attract more industries in the future

Resource Allocation

Materials

- Procurement program: special interest to the relationship with the suppliers and understanding the origin of the materials and the company
- Interest in quality assurance of materials and products, health and safety of personnel, human rights and environmental laws
- Incorporation of recycling practices into all phases of the project
- Reutilized four aeration tanks
- Recycled and reused materials from other projects in the construction phase
- Plans and programs for the decrease of waste during operation, aiming at recycling were implemented, selective collection of waste, sludge and flushing recycling
- Improved way of excavated materials allocation

Energy

- Reduce of energy consumption through efficiency and reliability
- Different processes to optimize efficiency during water production
- Utilization of biogas, installation of a solar plant, reduction of contracted power demand
- Feasibility study to assess the benefits of creating a solar pv plant next to the project

Water

- Savings of 2.58 billion liters of water per month
- The team successfully conducted different plans and design reviews to assess the best strategies for water recycling
- The project will help improve the water quality of a nearby river were domestic and industrial effluents were directly discharged → avoid further water pollution
- Strict control of all water treatment phases
- Internal monitoring system & all recycled water produced in the facility is monitored by an external certified laboratory → promotion of transparency
- The project has being awarded with three prizes for its positive impacts in the reduction in local industry potable water consumption and the improvement in the quality of life of adjacent communities: Global Water Award in 2011 and the FIESP Award of Water Conservation and Reuse in 2013

Natural World

Siting

- Project is located in an area that has been previously developed and severely modified by urbanization – classified as grayfield
- Geological study to assess the positive and negative impacts of the site
- Identification of potential impacts caused to the immediate environment by its construction, creating in response a number of mitigation, compensatory and control measures
- Negative impacts vary from moderate to very low and can be counterbalanced by the mitigation measures set
- Identification of the hydrological cycles and vegetation of the site that have been severely degraded before → implementation of a series of corrective actions
    - Locate the project pipeline elsewhere in order to avoid displacing of trees
    - Take care of the eucalyptus forest
- Location of the project not in direct contact with the river

Land & Water

- Conducted an assessment and monitoring plan of the quality of water of the river prior to the project's construction
- The team hired a specialized agency to generate an environmental report to prevent soil and water contamination
- Another agency was hired to monitor the nearby water bodies
- A nursery was created to grow different native species in order to recover the local environment

Biodiversity

- Identification of local animal and vegetation species that would potentially be negatively impacted by the project
- Extensive restoration of an existing natural habitat outside the site of the project through planting of native species of trees –planting of 1,417 trees covering an area of 8,500 square meters
- Aquapolo saves potable water for community use and avoids contaminated water to end up in the river

Climate and Risk

Emissions

- They should regularly monitor for noxious odors originating from the project → the Preliminary Environmental report concluded that the project does not produce any kind of odor

Resilience

- Aquapolo team created a contingency plan in which they address all possible emergency scenarios, decision making positions, impacts of those emergencies to surrounding communities
- Risk evaluation report to identify and quantify short-term threats, looking at their side effects or impacts together with potential mitigation measures

9. Pozo Almonte Solar PV Project, Chile

The Pozo Almonte and Calama Solar Photovoltaic Project, consisting of three solar power plants, will be located in the Chilean Atacama desert. The three plants will have a combined generating capacity of 26.5 megawatts. The Spanish company Solarpack will develop, build, and own the $80 million project.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- 390 new jobs will be created during the construction phase of the plant and preference will be given to workers from local communities
- The documents indicate that social programs benefiting children, women and Chileans of indigenous ethnicity will be given preference
- The plant may also open itself up to field trips for local area schools
- (**no** evidence that relevant planning documents affecting the area communities were reviewed and report only a minimal amount of social outreach, **no** specific social programs were identified, **no** improvements in job growth, capacity building, productivity, business attractiveness and/or livability, **no** formal cumulative impacts analysis)

Well-being

- The solar panels used in the plant will be selected and installed to be minimally invasive to the views in the landscape & the distribution of electrical power from the plant will not require the erection of new electrical poles
- Existing utility poles will be used for distribution, which will minimize the plant's negative effects on the landscape and views
- No requirement for improvements to public space since the plant is located in a rural sparsely populated area
- No long-term adverse effects on existing public spaces have been identified during all phases of the project
- Project located in an area with no identified historic and/or cultural resource

Community

- Anticipated volumes of automobile and truck traffic meet all the requirements enforced by the government of Chile and are not expected to have adverse effects on the local roads
- The plant will produce no significant noise or vibration
- The project sets standards for day and night operations for workers and plant machinery:
    - Requiring that all machinery noise levels be maintained no greater than the manufacturer's recommendations
    - Workers will be required to use ear protection during moments of high noise (if any)
    - Machines that produce the lowest levels of noise and vibration will be given preference in the operation of the plant, and
    - Any activity that will produce audible levels of noise and/or vibration will be reported to the local community. The community will be notified of the reasons for the noise and the duration for which temporary noise and vibration levels will last

Leadership

Collaboration

- The project's consultant and management teams worked together through the initial delivery phase
- Operations Director:
    - responsible for overseeing the subcontracting of the project construction
    - & the intercommunication and teamwork between departments
- A staff of 13 people will work as a team under the Operations Director during the initial construction phase, and throughout the long-term operations of the plant
- A consultant team of four from Solarpack which is responsible for providing the initial documentation needed for the construction and operations of the plant, aid communication and coordination during the preliminary period
- An Integrated Plan for Environmental and Social Management: Project's management system, scope, and policies, it stipulates how the project shall interact with its surroundings and workers to best protect the environment and human rights
- The project provides various means of communication for local residents who may have complaints or concerns regarding the plant, through a claims resolution process, & internally plant workers can also file claims through this same process

Management

- The project will address the electrical needs of the Tarapacá region of Northern Chile and help to lower the country's carbon footprint
- The plant's electrical output will be integrated into the region's existing electrical power grid, thus eliminating the requirement for new infrastructure to conduct voltage
- This project is expected to improve the region's electrical infrastructure

Planning

- Long-term monitoring of the project has been implemented within a central control room overseen by an operator who monitors irregularities in the plant over the course of time
- For any repairs or maintenance, the project has an independent engineer
- After the completion of the necessary repairs the operator will submit a technical report to management and the independent engineer

Resource Allocation

Materials

- The project has been designed to cause the least amount of disruption to the site as possible
- During the operation phase, the plants will separate waste and materials, classify them, and deliver them to an authorized recycling center that complies with corresponding environmental regulations
- Waste management plan during construction and daily operations: focus on re-utilization, recycling, and reduction whenever possible → goal is to reduce waste generation and find ways to recycle and reuse the waste that is already generated
- appropriate bins and management protocol has been put in place for both hazardous and non-hazardous waste
- All excavated soils and dirt on the site will be maintained within or near the project area, no excavation near any streambeds or areas prone to flooding

Energy

- The Pozo Almonte facility will generate 60,000 MWh of clean energy annually - equivalent to the energy consumption of 25,000 households
- All electrical energy needed to power the plant's operations will be produced at the facility
- Long-term monitoring of the project has been implemented
- 70% of the project’s energy demands will be provided by renewable energy sources

Water

- Approximately 100 liters of potable water are expected to be used at the site daily, as per the requirements of D.S. No. 594
- This water will be provided to the plant by a contracted company which is required to provide a certificate of the origins and quality of the potable water
- Project provides a sanitary solution system for the plant’s water consumption, maintained by an authorized company
- To prevent leaks and/or water damage, the project provides a water monitoring system. If any leaks are detected, the project supervisor will be notified immediately, and the leaks will be controlled and fixed.

Natural World

Siting

- The project is sited in a rural location outside of the urban core, and the impacts from automobile and truck traffic will be minimal
- The location is in an area with minimal rainfall, creating an environment that hosts little to no existing flora and fauna → not considered a prime habitat, undesired for farming
- The project will maintain natural ridges and slopes in the topography to the maximum extent possible

Land & water

- Project will monitor the proper disposal of toxic wastes, materials and/or liquids, prohibition of the use of any such toxic liquids near sources of freshwater
- Any observation of contaminated water will be reported and addressed immediately, a water quality monitoring system to assure sanitation quality

Biodiversity

- Low diversity of flora and fauna and little to no flora or fauna life due to the region's arid desert climate
- The project will help protect local biodiversity by educating its workers on local flora and fauna
- Hunting of animals, introduction of invasive species to the site, and starting bonfire are prohibited
- A perimeter fence around the site will be installed if an endangered species is found in the area

Climate and Risk

Emissions

- The energy generated at the photovoltaic plants is projected to reduce Chile's carbon emissions by 56,000 tons of CO2 each year
- The project provides a lifecycle report in the form of a Clean Development Mechanism (CDM) → The CDM makes the project net carbon negative, and thus eligible for funding as a net carbon negative project

Resilience

- Project has undertaken a 100-year analysis on flooding threats to the project area
    - study found that floodwaters would not rise greater than 0.5 meters over the next 100 years
    - the flow of water in the area's streambeds would rise 0.4 meters
    - Ground observations by staff

- Solutions presented by the study include channelizing the flow of these streambeds to control flooding in the area

10. Jari Hydropower Plant, Brazil

The Jari hydroelectric power plant is being developed in the States of Pará and Amapá in Brazil. EDP Energias do Brasil is developing the $1.3 billion power plant, which will have an installed capacity of 373 megawatts. The plant will be connected to the Brazilian Sistema Interligado Nacional.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Several improvements on the quality of life of nearby communities
- Only 94 families will be affected by flooding
- The dam has been located upstream from the Santo Antônio do Jari Falls, thus preserving this regional natural heritage
- The Basic Environmental Project (Projeto Básico Ambiental) states that it will relocate the affected families and offer them equal or better living conditions
- The project will stimulate sustainable growth and development in the region: increase in available and reliable renewable energy → improve economic conditions
- The project will diminish local deficits and better the quality of life by reducing costs and increasing the regional energy supply system
- The efforts developed by the project to help the cities of Vitoria do Jari, Laranjal do Jari, and Almerim in creating or updating regulatory plans are extremely important (since there is lack of infrastructure in the nearby cities)
- Professional training will be offered in several areas with the intention to develop local skills and capabilities
- The project established the goal of hiring up to 68% of the total number of workers in local communities, goal is raised to 100% when considering positions for non-qualified workers

Well-being

- A program for the preservation of archaeological heritage was developed, it aims to perform in-depth studies to identify areas of archeological heritage importance, in order to avoid them in the project (Through those archaeological studies, 14 sites were found)
- Developers analyzed the views and local character reservation regarding project sitting → aim to preserve landscapes of great scenic value

- The site of the project is regional natural heritage which was preserved by changes in the project **- transferring the dam** upstream from the falls
- All temporary and permanent **constructions** were concentrated on the right bank of the river – previously developed, avoiding the disruption of the left bank. The **height** of the dam was also designed considering the preservation of the flow necessary for the waterfall, the previous versions of the project did not considered the preservation of views
- The project developed a **Program of Documentation and preservation** of the Landscape heritage and Natural heritage
- Creation of new spaces including a soccer field, a roofed sports center and a square
- **Sensitive design decision, a highly relevant natural heritage area was protected and can continue to be enjoyed by the community**

Community

- **Public Health and Safety:** the team has assessed the specific risks and exposures created by the construction of the Jari Hydroelectric Dam
- They assessed which public health issues are most commonly associated with such projects to face such complex challenges, the Health program was divided into four subprograms:
    a) Subprogram for population health,
    b) Subprogram to control vectors
    c) Subprogram of epidemiological surveillance, and
    d) Subprogram of health education
- **Occupational health and safety**, are contemplated in the Programa Ambiental para Construção – PAC (Construction Environmental Program)
- Project developers have committed themselves to **strengthen local health facilities**, through partnerships with local governments
- **Use of the existing network of roads** previously developed by the cellulose industry, thus increasing overall efficiency and reducing - if not, urban sprawl - the need to cut down new areas of forest
- Efforts to encourage alternative modes of transportation, the project have developed a multi-modal system of collective transport, by bus and boat[38], for the exclusive use of workers.
- The site **accessibility and wayfinding** have been improved through proper signage and educational efforts regarding how to drive safely in dirt roads
- Efforts to improve **security** have been developed such as the construction of a new police station in the New Vila Iratapuru

Leadership

Collaboration

- The team has developed a number of specific policies including the following:
  1) Ethics Code,

2) Sustainability Policy,
3) Commitment to Stakeholders,
4) Integrated Policy for the Environment, Health and Safety,
5) Policy to fight corruption and bribery,
6) Policy for external social investment,
7) Biodiversity policy, and
8) Policy for diversity valorization

- Efforts and activities that are specific to Jari project
    - On a broad organizational level EDP, is committed since 2008 to foster a Corporate Environmental Management System for all its operations
    - ISO 14001 certification issued by the Lloyd's Register Quality Assurance.
    - By 2012, 81% of the installed generating capacity, including 4 hydroelectric dams were certified
    - A robust system of sustainability management is in place for construction phase: the developer and constructing consortium responsibility with preventing, minimizing and mitigating social and environmental damages during construction
    - Regarding collaboration and teamwork, documentation provided by the developers proves that the project has been done following a systemic conception
    - Responsibilities regarding sustainability are clearly stated for the construction phase
    - Jari HD has been designed with careful consideration of the natural and infrastructural systems into which it is inserted and with which it is integrated
    - Stakeholder involvement on the project by creating permanent channels of communication with community members, local governments and relevant actors are established
    - Several subprograms → involvement of the community (development of local skills, health and safety, awareness of cultural and environmental heritage, etc.)

Management

- Efforts have been made by project leaders **to reduce waste** and foster recycling → increasing efficiency and sustainability
- **Two programs** related to waste: the Program for the Recovery of Degraded Areas (Programa para a Recuperação de Áreas Degradadas - PRAD) and the Environmental Construction Plan (Plano Ambiental para Construção)
- **Environmental education initiatives** involving workers and communities also contribute to the reduction of waste
- Regarding the **improvement of Infrastructure integration**, the project team has developed actions to improve social and urban amenities in nearby communities
- However, it is clear that the **biggest contribution of the project to the regional and national infrastructural integration is the connection of Jari Hydroelectric Dam with the National Interconnected System** (Sistema Interligado Nacional - SIN) - Connectivity to the national network will be achieved via a 20 km long, 230 KV High Tension Line[61] (HTL) that is part of the Jari project

- **Synergies** at regional and national levels will be created with the 230 KV HTL connecting the Jari Hydroelectric dam with the Laranjal do Jari Substation, and with the high tension lines of the System Tucurui-Macapá-Manaus

Planning

- Planning for long term monitoring and maintenance is addressed in an addendum of the concession that extends the concession until the year 2044
- Recruitment process to assemble an O&M
- A number of plans regarding long-term monitoring of several aspectssuch as sediments, fauna, weather conditions, river flow conditions, etc.
- Three licenses issued by IBAMA are required for a project such as Jari[66]:
    - a Preliminary License (Licença Previa - LP) that certifies the environmental feasibility of the project;
    - an Installation License (Licença de Instalação - LI) which authorizes the beginning of construction; and finally,
    - an Operation License (Licença de Operação - LO) authorizing filling of the reservoir and the beginning of energy production
- Project developers have identified all applicable regulations
- They have assessed potential conflicts, working closely with regulating organizations

Resource Allocation

Materials

- Significant efforts were deployed to support **sustainable procurement** practices, the purchase of all materials and equipment must follow the guidelines of the Corporate Normative System (Sistema Corporativo Normativo) → specific procedure is in place to qualify and evaluate service suppliers and a second procedure is in place to qualify and evaluate material suppliers
- Strong set of supplier evaluation practices
- Around 5% of the project materials are **recycled** or reclaimed, around 10% of the materials used on the project are **locally sources**
- On **diverting waste from landfills**, the project team has developed consistent efforts → specific subprogram regarding pollution control[79] is in place for minimizing waste, appropriate classification and destination of residues, recycling, etc, approximately 25% of all waste generated was recycled or reused
- On the **reduction of excavated material** taken off site, the developers have declared that the project is designed to balance the volume of soil extracted and reused to build the dams and roads, approximately 40% of the materials excavated were reused on site

Energy

- The project will produce positive impacts: with an installed capacity of 373.48 MW Jari Hydroelectric Dam is clearly a net positive source of renewable energy, capable of providing electricity to approximately 3,000,000 citizens

- Renewable energy sources were also deployed in projects such
- Solar energy systems will contribute in providing electricity to the houses and streets

Water

- Jari Hydroelectric Dam will have a net neutral impact on water quality and availability
- The Basic Environmental Project (Projeto Básico Ambiental - PBA) defines two detailed monitoring programs regarding water quality:
    - a program of limnological[92] (inland water) monitoring and
    - a program to assess impacts on sections of reduced flow
        - ➔ The information produced by these monitoring programs will be consolidated in a database & third party assessment

Natural World

Siting

- Compensation measures are properly established within the environmental license and the program for the recovery of degraded areas (Programa de Recuperação de areas degradadas - PRAD)
- A new environmental buffer zone of 100 meters (approximately 330 feet) will be established around the lake
- Significant efforts were implemented to minimize negative impacts on water resources and the landscape such as locating the dam upstream from the Santo Antônio do Jari Falls to preserve the region's natural heritage
- All temporary and permanent structures were concentrated on the right bank of the river - which was previously disturbed by anthropogenic activity - in order to avoid disruption of the left bank
- Development took place on land not considered prime farmland or relevant for agricultural purposes
- Consistent efforts were developed to preserve floodplain functions
- The project limits the use of impervious surfaces, restricted basically to the engine house and the dam, and does not have a significant impact on water infiltration
- A new lake with a surface of 31.7 square kilometers will be formed by the dam, thus changing the floodplain areas
- A program for the recovery of degraded areas (Programa de Recuperação de Áreas Degradadas - PRAD) is being implemented → recovering all areas affected by the project
- The project has also taken into consideration habitat connectivity and sediment transport

Land & water

- Significant efforts have been put in place by project developers in order to **manage stormwater** and reduce **the generation of stormwater** runoff

- A Program for the Recovery of Degraded Areas[106] (Programa de Recuperação de Áreas Degradadas - PRAD) and a Program to Control and Monitor Erosive Processes (Programa de Controle e Monitoramento de Processos Erosivos) are in place → to restore vegetation using native species
- Some actions are being taken to prevent surface and groundwater contamination – a program for monitoring the water table[108] (Programa de Monitoramento do Lençol Freático) is in
- Regarding surface water → a detailed Internal Monitoring process has been planned and is currently being deployed
- Regarding surface water quality: Program of Limnological Monitoring and Program to Assess Impacts of Reduced Flow
- Regarding spill and leak preventionand response plans, the following procedures are in place: Subprogram for Pollution Control During Construction Workand a Subprogram for Risk Management and Emergency Actions

Biodiversity

- Regarding preserving species biodiversity, a number of programs is being developed
- The project team has worked throughout the extended licensing process with several public entities at the federal, state and local levels in order to identify special habitat areas in and near the project site
- In spite of significant efforts to avoid damage, the artificial lake will produce impacts upstream from the dam → impacts have been assessed as local, direct, permanent, non-accumulative, non-reversible, and of medium importance and small intensity
- Mentioning that compensation measures are properly established in the environmental license and in the Program for the Recovery of Degraded Areas & new environmental buffer zone of 100 meters
- The developers have been especially careful in regards to controlling invasive species – they will only use native vegetation
- The PRAD and the Program to Control and Monitor Erosive Processes (Programa de Controle e Monitoramento de Processos Erosivos) are in place to restore disturbed soils
- In Maintaining wetland and surface water functions, based on documentation provided, the Jari Hydroelectric Dam appears to maintain the following ecosystem functions:

    - Hydrologic connections
    - Water quality
    - Habitat
    - Sediment transport

Climate and Risk

Emissions

- According to documentation provided by the project developers, Jari Hydroelectric Dam is a net carbon negative endeavor
- The project fulfills the requirements of the Clean Development Mechanism (CDM) under the Kyoto Protocol
- Through the construction of Jari HD and the connection with the National Interconnected Systems, the region will be able to reduce CO_2 emissions associated with isolated thermo-electric generating units that run on fossil fuels
- Overall reduction in emissions has been estimated at 352,648 tons of CO_2 equivalent per year, and a total of 2,468,535 tons of CO_2 equivalent over a period of 7 years
- Jari Hydroelectric Dam will also contribute significantly, both in local and regional scales to reduce air pollutants emissions

Resilience

- In assessing climate threats, the team has cretaed a Program for climatic and meteorological monitoring → to assess climate threats
- Jari Hydroelectric dam received a good evaluation in preparation for short-term hazards
- Documentation presented by the project team states that the infrastructure has been designed considering once in 100-year hazard
- The key design considerations considered are floods, rain and water flow in the Jari River

11. Mariscal Sucre International Airport, Equador

The Mariscal Sucre International Airport, located outside Quito, Ecuador, has been developed by the international consortium Quiport S.A. (AECON, Airport Development Corporation and HAS Development Corporation, from Canada, and AG-CCR, from Brazil). The $700 million greenfield project provides a 4.1 kilometer runway, passenger and cargo buildings, navigation and storm water systems, as well as a general aviation building and buildings for wastewater treatment.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Emphasis has been placed on **hiring local** individuals and companies, and on providing necessary **training** to comply with legal and technical requirements of the project

- Creation of comprehensive **Social Management Plan** that includes continuous **public consultation and participation** with all the communities affected by the project, as well as permanent monitoring to measure impacts
- employment training and targeted investments to improve the overall livability of the surrounding parishes
- **Open communication/constant contact** with all interest groups
- Exports/ air transportation are growing, → significant contribution to the **region's development** and promotes employment of residents in the surrounding communities (new businesses and industries linked to airport activities)

Well-being

- The project does not negatively impact historic sites, local character, or existing public spaces – it will have a significant impact on the livability of surrounding communities
- Will generate new airport-related industries, increase traffic, and cause changes to property values
- Exploratory activities were performed regarding archaeological monitoring to ensure the protection and preservation of cultural and historical resources
- To **mitigate visual impacts of the project**, several measures have been taken to restore vegetation in affected areas:
    - A reforestation plan using native species (acacias) to restore the landscape to its natural condition prior to agricultural activity and the introduction of foreign species into the ecosystem
    - Investing in the preservation of the surrounding system of ravines, watercourses, wildlife, and native forest

Community

- One of the biggest concerns has been to ensure the **public health and safety** of all actors involved in different phases of the project, and to minimize negative impacts on the adjacent communities
- Higher **standards** for industrial safety and occupational health have been followed in excess of local requirements, **policies and procedures** to minimize risks (construction phase)
- **Study** of safety and wayfinding signage was implemented to improve accessibility to the airport, passenger movement within the terminal building, and physical safety and security measures in relation to the operation of the building (operational phase)
- Targeted investments which have provided **funds** for community sporting facilities and equipment, and education programs & programs implemented to advance the wellbeing of the larger social fabric of the area

Leadership

Collaboration

- **Environmental Management Plan (EMP)** and the **Social Management Plan (SMP)** provide blueprints for the project's principles of sustainability → Address economic, environmental, and social aspects of the project, and include concrete activities and continuous monitoring to ensure that proposed goals are achieved
- **Environmental Management System (EMS)** → operates under the guidelines of EMS and ISO standards
- collaborations between a broad set of stakeholders and a **multidisciplinary team** with the objective of optimizing the overall performance of the NQIA
- **Public Consultation and Disclosure Plan (PCDP)** → ensuring adequate information to protect and include affected people and other stakeholders in the process
- Plan to lead the **closure and abandonment** of the old airport, and to reintegrate the area into the city of Quito
- Implementation of an **Infractions System for Commercial Operators** that responds to the needs of the project to socialize, educate, monitor, and supervise corrective actions in resources management

Management

- To reduce project **costs and the use of raw** materials, soil extracted during excavation was used in filling and leveling
- In terms of the **transportation** network → regional strategic plans and municipal road improvement projects in its location and design
- The project team improved the existing road infrastructure in order to achieve a better connection between the airport and Quito
- According to the Metropolitan Road Plan, in the future two roads will connect the airport with the existing road network. Today, the only access is over the South road, known as Ruta Zambiza.
- Quitport provided **additional investments** for the Alpachaca connector road, which was required to link the airport to the existing transportation network. The North road connection, known as Ruta Collas, is currently under construction.
- In terms of **water infrastructure** → integrated water management system to prevent water contamination and flooding

Planning

- Plans regarding **ecological protection, mitigation and enhancement** measures were incorporated at the early stages of the NQIA project → definition of long-term strategies and monitoring measures
- To guarantee plan implementation, **funds and responsibilities** were assigned and specific people and organizations have been designated to monitor and maintain the different programs included in the project

- **Conflicting** regulations/**barriers** to the implementation of sustainable practices in the airport, three different issues have been identified
    - Two conflicts relate to the requirement for changes to land use in reclaiming the old airport site as a park, and in developing the new airport on a rural site → participation in a **closure plan and land use study**, and helped the municipality of Quito update its **land use ordinance**
    - The third conflict is related to nitrogen oxide (NOx) emissions → **Strategy for Reducing Emissions of NOx** for the NQIA was developed to provide realistic mitigation measures to reduce NOx emissions with complementary restrictions for airplanes

Resource Allocation

Materials

- **Comprehensive Waste Management Plan**: use of a waste classification system for the collection, disposition and management of all the solid residues produced by airport operations (estimated 50% of the total amount of waste is recycled or reused and 50% is disposed in authorized landfills)
- Minimization of **earth removal** from the site → cut and fill operations reduced the amount of excavated material taken off site – goal: to avoid any net import or export of earth by reusing the excavated material for filling or leveling
- Any subcontractor must accept the environmental standards established in the EMP

Energy

- **Internal monitoring** of the energy systems and continuous training programs for maintenance personnel to ensure efficient functioning of all operating systems
- The managers are considering implementation of a photovoltaic system

Water

- **Stormwater management system** that provides for separation of sediments, accumulation of water in ponds, rainwater harvesting and reuse of water in airport gardens → reduce impacts to aquifers, groundwater and freshwater sources.

- A system to **manage wastewater treatment,** implementation of a biannual **program** to monitor water quality → detailed identification of potential impacts, detect sources of water pollution and put appropriate measures in place quickly (groundwater, surface water, wastewater & rainwater)
- Concrete **measures and prevention strategies** and a list of **best practices** protect water resources →no net impact on water supply volumes
- **Water Contamination Prevention Plan**

Natural World

Sitting

The NQIA occupies an area of about 1,500 ha on a plateau surrounded by deep ravines and forests that represents a valuable natural fragile ecosystem.

- Plan to legally designate this area as **"Protected Forest"** as well as a **native species reforestation program** that will contribute to the overall capacity for stormwater absorption
- In addition, the project implements a 155.5 ha **buffer** from the edge of streams within 100m of the site inwards towards the plateau → help preserve existing water bodies, maintain and enhance the surrounding habitat
- Establishment of permanent monitoring programs for water body and wildlife quality

Land & Water

- **Integrated Management Plan for stormwater and wastewater** → determination of the physical characteristics as well as the operational and maintenance parameters of both systems
- It coheres with **local** regulations **and international regulations** of OACI (Organización de Aviación Civil Internacional), includes a detailed program for monitoring and **water quality assessment**, and makes reference to spill prevention, training mechanisms and community consultation
- The **Stormwater Management System** contains a System of Rainwater Harvesting that consists of open ditches, culverts, storm drains, a separate pool for Stormwater Management (which includes treatment), and a drainpipe to the Guayllabamba River → designed to capture and repurpose more than 100% of on-site stormwater, ensure that contaminants are not introduced into any contaminated or non-contaminated waterways
- Hydrological testing of the streams by the WALSH Company will help determine whether any negative effects of discharged runoff are realized.

Biodiversity

- A **Plan of Protection and Rescue of Sensitive Wildlife** has been proposed and implemented → series of activities and measures for the **protection and recovery of sensitive wildlife** and outlines strategies **for mitigation of disturbed habitats**, specifically in the case of the Burrowing owl
- An **Ecological Compensation Plan** was implemented to **restore** individual Acacia Macracantha carob trees affected during the construction process of the NQIA
- Stray dogs will be actively removed and discouraged from the area through the proper management of waste

- Conservation of both surface water functions of stream systems located in the surrounding ravines and the drainage and groundwater systems in the area → studies to maintain or enhance hydrologic connections, water quality, surrounding habitat areas, and to restore sediment transport
- The location of the project both avoids infringement upon the natural water flows and restores disturbed functions to prior levels by including a wastewater treatment plant to treat and reuse water
- An exhaustive water monitoring process was carried out → to ensure that the project fully restores disturbed functions in the existing ecosystem

Climate and Risk

Emissions

- **Strategy for Reducing Emissions of Nitrogen Oxides (NOx)** → realistic mitigation measures and strategies, the background air quality concentrations at the proposed airport will be lower than at the existing airport, which is within an urban setting
- Aircraft efficiency is greatly improved at the proposed location due to the lower elevation, which will translate into fewer emissions per unit of takeoff weight than at the existing airport.
- An equal tonnage of air traffic and associated road traffic, the overall air quality in the vicinity of the proposed airport will be better than the air quality around the existing airport.

Resilience

- Short-term risks are properly considered and identified for all phases of the project
- The project is designed to resist seismic activity and minor damages caused by an earthquake of Ms> 7 with a 475-year rate of return → evacuation routes and emergency protocols
- Plans and protocols are established to respond to fires, explosions, accidental spills, transit accidents, and labor accidents
- An integrated water collection system was designed to avoid flooding and landslides

12. Vías Nuevas de Lima, Peru

The Vías Nuevas highway is a 30-year urban highway concession to expand and upgrade the access to Lima, Peru. The highways will be developed by Consorcio Líneas Viales de Lima (Odebrecht Investimentos and Constructora Norberto Odebrecht S.A., both from Brazil). The $590 million project will facilitate transit in the North, East and South of Lima, and will expand and restore a total of 115 km.

The key sustainability initiatives and achievements of the project are listed below, organized along the Envision rating system categories.

Quality of Life

Purpose

- Outlined an **elaborate social and economic program**
    - goal of generating **job opportunities** (with or without contracts) → Prioritize residents with job openings with Rutas de Lima and their service and material providers
- **"Productive insertion":** Creates/fosters **businesses** to generate **self-sustaining jobs** that outlive the construction of the project and that are not dependent on contracts with Rutas de Lima, functions and operations have to comply with certain rules to ensure that no harm to environment and the natural resources will occur
- Adopt sustainable practices: Respecting and prioritizing local culture, skills and construction
- A strategy to develop the **local skills and capabilities** of adjacent communities with aim to integrate **education and mobilization** to increase productivity levels within the greater metropolitan area of Lima

Well-being

(Lack of detailed documentation)

Community

- **Design** decisions based on mobility and access needs of nearby communities
- Design alternatives through updated information from traffic flows
- Improve pedestrian mobility and access to public transportation on both sides of the highway → bridge communications & access between two sides of the highway
- Commute times from Lima to other important production centers more agile
- A **manual**, prepared by the project team, on how to prevent environmental and work-related emergencies was distributed to the management and contractors
- **Clear documentation** directed at different education levels to address accessibility, safety and way-finding
- Distribution of electronic and physical **brochures** were distributed to the general public to increase public awareness of highway's safety and protection plan on accidents or emergencies
- Thus, the team has been **successful at developing and implementing a public safety p**lan and at making it **accessible** to every sector of the socioeconomic spectrum of Lima.

Leadership

Collaboration

- A clear **sustainability policy** as well as sustainability **manuals and procedures** for environmental and administrative work spaces
- System of procedures that integrate elements of sustainability, management and social life
    - Initiatives to be taken during the 2 phases of the project
        - Phase 1: Design & Planning
        - Phase 2: Construction & Operation
    - Providing “Seguridad y Salud en el Trabajo y Medio Ambiente”
    - (SSTMA) education
    - Clear and precise procedures for climate change related disasters
- Parallel and iterative process of interviewing, **understanding and incorporating** the needs of local people into the project, including residents who walk the highways, bus/truck/taxi drivers, and private drivers
- Social studies → successfully incorporate the community into the design and construction
- Communication between ownership, management, and supervision is necessary to achieve overall sustainability
- These processes are **non-linear**, and all teams collaborate to the extent needed

Management

- The project benefits and includes local communities through the creation and promotion of **new job opportunities and increased participation**
- The strategy utilized is known as **“Productive Insertions,”** whereby communities are enhanced by means of education promotes education with a focus on professional skills and productivity that will generate new self-sustainable businesses and enhance community competitiveness
- **Community involvement**

Planning

- Detailed plans for monitoring and maintenance were put in place that identify possible services to be provided, the level and type of repairs to be done, and the length of time for each repair type

Resource Allocation

Materials

- Strategies to **limit the excavated materials** taken off-site; excavation and cut methods that require less soil to be extracted and creation of storage facilities for the soil that is not used immediately → less impact during construction, storage
- Specification of materials that can be **reused and recycled** during and after construction phase

- creation of a system that facilitates procedures for separation, correct disposal and reuse of materials (in the future) → cyclical system
- **"Comprehensive Waste Management Plan"**
    - Decrease overall project waste and to divert waste from landfills and incinerators during operations
    - Potential destinations for waste generated on site
    - Waste should be managed according to System of Environmental Action
    - Waste generation on site:
        - Treatment should minimize residue → lowest degree of pollution
        - Receptacle according to waste classification and treatment characteristics
        - Controlled hydrocarbon management and manipulation
    - Waste destinations:
        - Excess materials disposal "Flor de nieve"
        - Other waste disposal "Deposito San Martin"

Energy

(Lack of detailed documentation)

Water

(Lack of detailed documentation)

- The team tried to address the local shortage of potable water, implementation of rations/restriction for the use of potable water during construction
- During the life of the project, mechanisms for water reutilization

Natural World

Sitting

(lack of detailed documentation)

- Diagrams of proposed construction efforts to avoid the development of steep slopes, protect riverine ecosystems and prevent particulate matter from entering the water

Land & Water

(Lack of detailed documentation)

Project is situated within less than 120 meters of three major bodies of water that feed or receive surface and groundwater

- Ways of preventing chemicals and solids to enter the water resources
- Vehicles in the construction site must not drive at high speeds, maintenance for vehicles
- Appropriate drainage systems for the protection of the water resources

Biodiversity

(Lack of detailed documentation)

- Identification of a **migratory bird** that has made construction site its home, environmental directive to ban egg collection
- Plans that inhabit the area, steps to minimize the impact of chemicals
- **Best practices for soil management**: cutting excavating, infilling, soil must be recycled on site, storage facility, 100% of the soil will be reutilized on site

Climate and Risk

Emissions

(Lack of detailed documentation)

- Measures to **monitor greenhouse gas emissions** but not properly assessed level of achievement

Resilience

(Lack of detailed documentation)

- **Short-term hazards** by differentiating between man-made and natural or climate-related hazards
- Each hazard has been awarded a level of impact (mild, moderate, severe)
- **Emergency reaction** since they know the geographical position and severity of impact

References

Alonso, J., Arellano, A., Tuesta, D. (2015). Pension Fund Investment in Infrastructure and Global Financial Regulation. Pension Research Council Working Paper 2015-22. Retrieved from https://pensionresearchcouncil.wharton.upenn.edu/wp-content/uploads/2017/01/WP2015-22-Alonso-et-al..pdf

Cerra, V., Cuevas, A., Goes, C., Karpowicz, I., Matheson, T., Samake, I., Vtyurina, S. (2016). Highways to Heaven: Infrastructure Determinants and Trends in Latin America and the Caribbean. IMF Working Paper 16/185. http://www.elibrary.imf.org/abstract/IMF001/23713-9781475536744/23713-9781475536744/23713-9781475536744.xml?rskey=2sNJUt&result=9&redirect=true

Inderst, G., and Steward, F. (2014). Institutional Investment in Infrastructure in Emerging Markets and Developing Economies. World Bank Public-Private Infrastructure Advisory Facility (PPIAF). Retrieved from http://documents.worldbank.org/curated/en/748551468337163636/Institutional-investment-in-infrastructure-in-emerging-markets-and-developing-economies

Lokmanis, Toms. (2016). Investing in Infrastructure: As Needs Expand, So Do Opportunities. http://www.ifebp.org/inforequest/ifebp/0200295.pdf

Mercer. (2017). Crossing the Bridge to Sustainable Infrastructure Investing: Exploring Ways to Make it Across. Retrieved from https://publications.iadb.org/handle/11319/8242

OECD. (2016a). Annual Survey of Large Pension Funds and Public Pension Reserve Funds: Report on Pension Funds' Long-term Investments. Retrieved from http://www.oecd.org/daf/fin/private-pensions/2015-Large-Pension-Funds-Survey.pdf

OECD. (2016b). OECD Business and Finance Outlook 2016. Retrieved from http://www.oecd.org/investment/investment-policy/BFO-2016-Ch5-Green-Energy.pdf

PwC and Global Infrastructure Investor Association (GIIA). (2017). Global Infrastructure Investment: The Role of Private Capital in the Delivery of Essential Assets and Services. Retrieved from http://www.pwc.com/gx/en/industries/assets/pwc-giia-global-infrastructure-investment-2017-web.pdf

Serebrisky, T., Suárez-Alemán, A., Margot, D., Ramirez, M.C. (2015). Financing Infrastructure in Latin America and the Caribbean: How, How Much, and by Whom. Retrieved from https://publications.iadb.org/bitstream/handle/11319/7315/Infrastructure%20Financing.%20Definitivo.pdf?sequence=1

Shendy, R., Kaplan, Z., Mousley, P. (2011). Towards Better Infrastructure: Conditions, Constraints, and Opportunities in Financing Public-Private Partnerships in Select African Countries. World Bank Study 63433. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/2331/634330PUB0Towa000public00BOX361512B.pdf;sequence=1

Tuesta, D. (2015). Infrastructure Investment in Latin America: Pension Funds, Capital Markets, and Financial Regimes. BBVA Research. Retrieved from https://www.bbvaresearch.com/en/publicaciones/infrastructure-investment-in-latin-america/

Watkins, G., Mueller, S., Ramirez, M. C., Meller, H., Blatsos, I., Carvalho Fernandes de Oliveira, J., Contreras, C., Georgoulias, A., Georgoulias, N., Rodriguez, J. (2017). Lessons from Four Decades of Infrastructure Project-Related Conflicts in Latin America and the Caribbean. Retrieved from https://publications.iadb.org/handle/11319/8502