INDEPENDENT ADVISORY PANEL ON DEVELOPMENT ISSUES IN SOUTH CENTRAL PERU

FIRST CONSOLIDATED REPORT (2010-2014)

CAMISEA: EMERGING LESSONS IN DEVELOPMENT

south Peru panel

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Preface

In January 2008, the Export-Import Bank of the U.S. (Ex-Im Bank) authorized financing to cover U.S. exports associated with the construction of the Peru Liquid Natural Gas (LNG) plant by Hunt Oil Co. The authorization followed an extensive review by the Bank's Engineering and Environment Division of the potential environmental and social impacts that the project could have on the areas affected by said pipeline, the LNG plant itself at Pampa Melchorita, and the adjacent marine terminal.

In conjunction with its decision to authorize financial support for the Project, the Bank instructed its staff, with support from the Project's sponsors, to establish an Independent Advisory Panel composed of no fewer than three recognized and eminent experts or scholars in environmental and social science to conduct annual reviews and prepare reports to the Bank and other lenders regarding the impacts associated with all phases of both the Peru LNG Project and the upstream Camisea gas project in the broader context of hydrocarbon-related and other development activities in Peru. This condition of financial support was unique in that it went beyond the usual monitoring of a project's social and environmental impacts. The objective of this condition was to obtain and make available information for interested parties on the cumulative positive and negative effects associated with the development of the hydrocarbon sector in South-Central Peru.

With assistance from the U.S. Embassy, the Bank was able to identify many qualified candidates, and by mid-2009, four Panel members were selected. Dr. Gonzalo Castro de la Mata, who specializes in ecology and sustainable forestry management, was named Chairman of the Panel, which also consisted of Dr. Richard Chase Smith, an expert on land use allocation and impacts to tropical rain forests, and Dr. Glen Shepard, an anthropologist with expertise in Brazilian and Peruvian indigenous peoples. A fourth member, Dr. Richard Korswagen, a Peruvian professor of anthropology, was able to serve on the Panel for only a short time and was replaced by Dr. Patricia Majluf, a renowned expert in marine fisheries. Dr. Juan Jose Garrido and, subsequently, Dr.

Miguel Enrique Santillana, both of whom are economists with expertise on the social impacts of energy projects, have since served as the Panel's fourth members.

In late 2014, Dr. Castro de la Mata announced his resignation from the Panel in order to assume a position with the World Bank. Dr. Smith, who had contributed greatly to the Panel since its inception, was also forced to resign for health reasons at the end of 2014. We are now pleased to announce that Dr. Pedro Gamio Aita, a former Deputy Minister of Mines and Energy in Peru, who brings to the Panel expertise in renewable energy and public policy, has agreed to Chair the Panel. Our appreciation goes out to all the current and past Panel members who have contributed so much of their time and talents, pro bono, to producing this first "Four Year Consolidated Report" on development issues in South-Central Peru. We wish to thank Peru LNG for its funding of the Panel's expenses over the past five years and the gracious cooperation it has extended to the Panel members. Finally, we also acknowledge the valuable contributions of the Panel's Secretariat coordinators, Ms. Lucia Sato and, more recently, Ms. Amalia Delgado.

In closing, Ex-Im Bank is proud to be associated with the work of this distinguished Panel, and the Bank is particularly pleased with the efforts of its members that have led to this Report. It provides an independent analysis of a wide range of issues related to the region's development, including insight on the national benefits to Peru of energy extraction activities, while identifying weaknesses in the administration of some environmental and social policies needed to help mitigate or offset the impacts associated with regional development. Finally, the Report presents recommendations to improve project practices and to strengthen institutional oversight and activities in order to promote sustainable development in South-Central Peru.

James A. Mahoney, Karl Kendall, and Stephen C. Parsons

The Engineering and Environment Division

Export-Import Bank of the United States

Executive Summary

Background

This consolidated report summarizes the results of the first five years of work of the Independent Advisory Panel on Development Issues in South-Central Peru (The Panel), formally established at the end of 2009 to advise the Export-Import Bank of the United States (Ex-Im Bank) and other interested parties on the environmental and social effects of development in South-Central Peru, in the context of the Peru LNG project.

After five years of work, a "picture" is emerging about exactly what Camisea has meant for Peru. The findings and lessons presented here have broad applicability within the country and elsewhere with regard to the challenges and opportunities for developing hydrocarbons responsibly in the context of fragile ecological and social environments.

The geographic areas covered by the Panel (the region of South-Central Peru) reflect ecological realities that have shaped the social characteristics of the people living there, as well as their interactions with the environment and natural resources. The Panel took a broader look at long-term issues that define the way Peruvian society interacts with its environment, addresses poverty, attracts foreign investment, and attempts to develop that region. Over time, the Panel was able to gather information, identify sources of data, and interview key players so as to develop a proper understanding of the context in which these complex issues can be studied.

Peru's geography provides the abundant natural resources that have fuelled export sectors such as guano, saltpeter (nitrates), rubber, fishmeal, and others in the past. Unfortunately, many of these extractive activities have left behind "boom and bust" cycles and have not been sustainable. Tragically, it is the presence of these rich resources that, according to many, has prevented Peru from investing in its human capital or diversifying its economy. Now that the rich gas fields of the Camisea region are finally under exploitation, it is crucial to make sure that history's lessons are applied in order to avoid past mistakes. Therefore, the central question that the Panel aimed to answer was: "Has the country been able to develop Camisea in a sustainable economic, social, and environmental manner?"

With an investment of nearly US$4 billion, the Peru Liquefied Natural Gas Project or PERU LNG (also known as Camisea II) was the largest foreign direct investment in Peru's history at the time of its approval, and the first LNG export project in Latin America. It was planned to be carried out with extreme attention to the introduction of cutting-edge environmental engineering, minimal ecological impact, sensitivity to cultural heritage, efficiency in redressing

communities' needs and complaints, and a treatment and shipping facility that meets or exceeds the highest international standards.

Economic Aspects

The natural gas industry in Peru was not highly developed before Camisea, and thus, its most obvious impact on the Peruvian economy has been its rapid "gasification." Gas use for electricity generation has increased from less than 1% in 1996 to over 60% in 2014. Direct use of gas has also grown dramatically.

To better understand future trends in gas demand, various scenarios were developed using the expected growth in demand for electricity, hydrocarbons, and natural gas. The baseline scenario using proven reserves of 12.46 TCF of natural gas and 657,968 barrels of natural gas liquids concludes that the proven natural gas reserves (including liquids) will be sufficient to meet demands through 2021 only, assuming a conservative GDP growth of four percent per year. Even if, in the next few years, ten percent of possible reserves and fifty percent of probable reserves become proven, gas supply can be stretched to the year 2025 at the most. If policies were introduced to prevent natural gas from being used for electricity generation (in order to promote renewable sources of energy, including hydropower), the supply would only last through 2026.

In terms of macroeconomic results, the Panel estimated savings from Camisea (calculated as the difference between the expenditures in Camisea's natural gas for electricity generation versus the amount that would have to be spent on diesel to produce the same amount of energy) to be US$17.1 billion. These are very significant savings with a marked impact on Peru's overall competitiveness. Savings in transport (the difference between the expenditures on Camisea natural gas for vehicle fuel and the amount that would have to be spent on diesel) were estimated at US$756 million. In terms of trade balance, there is an accumulated difference of US$21 billion since Camisea came into operation; of this, 72 percent represents import substitution, reducing the Peruvian economy's risk exposure to international hydrocarbon price shocks.

Natural gas has become a critical input for the entire Peruvian economic system, and thus, a sudden halt in Camisea's capacity to supply gas would have a dramatic effect upon it. Despite methodological challenges explained in the report, the Panel estimated that 28 percent of the GDP would be paralyzed if the Camisea supply was brought to a sudden halt. Should it be interrupted for two weeks, annual GDP would fall by 1.1 percent, although this estimate is probably in the low range because of the considerable macroeconomic effects caused by lower investor confidence or sudden negative exchange rate shocks. Finally, using an input–output

matrix for the sector, the Panel estimated that Camisea creates around 57,000 jobs nationwide. This figure may underestimate Camisea's employment effect because of the static approach used in this analysis.

The positive economic effects of the Camisea project on the Peruvian economy are extremely important and without precedent in Peru's modern economic history, being comparable only to the effects of the guano boom in the nineteenth century.

Ecological and Environmental Aspects

The Panel also analyzed the following ecological and environmental impacts (both positive and negative) of Camisea: (i) Amazonian deforestation; (ii) greenhouse gas emissions from energy and deforestation; (iii) biodiversity and its monitoring; and (iv) marine ecosystems.
From the perspective of the ecological integrity of the Amazon Basin, it is widely acknowledged that avoiding the loss of forest cover (a.k.a. deforestation) is the most important principle for reducing ecological impacts and conserving biodiversity. The Panel estimated the actual direct deforestation and resulting emissions of greenhouse gases caused by hydrocarbon development, and compared it with alternative forms of land settlement in the Amazon. Five study areas within the Peruvian Amazon were selected based on their main economic activities: (i) hydrocarbons (oil and gas); (ii) cattle ranching; (iii) artisanal mining; and (iv) palm oil. Forest loss was more intense in the case of palm oil (4.7 percent per year) and livestock, where agriculture has expanded considerably and forest has been turned into pasture (2.09 percent per year). In the case of illegal and artisanal mining, deforestation represented a loss of 7,381 ha of the study area equivalent to 10.5 percent of its extension. Oil in the northern Amazon region was responsible for a loss of 0.17 percent per year.

The lowest deforestation rate was found in Gas Blocks 56 and 88 (Camisea), corresponding to the "roadless" (or "inland offshore") hydrocarbon model, with an annual deforestation rate of only 0.001 percent. These differences are striking: hydrocarbon activities without roads produce the lowest deforestation, which for practical purposes can be considered negligible. The Panel notes that Blocks 88 and 56 were already titled to Matsigenka communities before Shell began exploration in Camisea, and this has played an important role as well. In contrast to other unsustainable models of territorial settlement, Camisea has provided a unique opportunity to generate very substantial wealth and economic growth to the nation as a whole, while almost completely avoiding any negative ecological impacts.

The observed deforestation patterns also result in emissions of greenhouse gases due to the release of carbon dioxide to the atmosphere. As expected, annual average GHG emissions of

hydrocarbons projects analyzed are much lower compared to the other economic activities studied.

The Panel studied the Biodiversity Monitoring Program (BMAP), a collaborative program between the Center for Conservation Education and Sustainability (CCES) of the Smithsonian Conservation Biology Institute (SCBI) and the company PERU LNG. The BMAP establishes long-term monitoring and evaluation protocols for species and habitats that are important for conservation. The BMAP emphasizes the active participation of local nationals in the fieldwork and research activities. To date, the fieldwork has involved 104 principal investigators from Peru out of a total of 110, representing a participation rate of 94.5 percent Peruvian researchers, a significant capacity-building benefit for biological sciences in Peru. The Panel found that the BMAP represents one of the most comprehensive biological monitoring efforts ever conducted in Peru. Several of its attributes can be considered best practices in biodiversity monitoring. Additionally, many of these practices go beyond the legal requirements established by the Peruvian EIA system regarding biological monitoring, establishing long-term ecological studies on distribution, abundance, and functional interactions of the project with the ecosystem, as opposed to simply putting together lists of species observed. This results in a better understanding of the project's potential impacts from an ecosystem-functioning perspective.

The Panel also started the basic characterization of the project's impacts upon the marine environment by describing avian biodiversity in the newly formed marine ecosystem at its export facilities at Melchorita, as well as analyzing some of the changes at the Paracas terminal. An attempt was also made to study morphological changes in the marine environment south of Melchorita, but the results were not conclusive and thus are not included here.

The physical infrastructure at Melchorita includes a new large pier and a large artificial "island" (breakwater) to allow ships to uptake the liquefied gas. These structures have created new marine habitats which, by virtue of their protection, visibly provide habitats for numerous species of birds, some of which are of conservation concern. The breakwater serves as a very important breeding habitat for the Humboldt's Penguin, a threatened species, protecting close to 500 individuals, which represent around 10% of the entire Peruvian population. The physical export infrastructure has thus created an artificial ecosystem that, through ecological succession, is starting to resemble a typical "Guano Island," the main habitat for numerous marine birds in Peru. A highly diverse and rich marine ecosystem is developing, and its evolution needs to be monitored.

In Paracas, the construction of the infrastructure for the handling of the liquids associated with Camisea in 2004 raised a number of environmental concerns related to the proximity of these

facilities to the Paracas National Reserve and an allegedly fragmented EIA approval process. As a result, rigorous environmental conditions were introduced by the IDB and CAF, two of the main funders. The Panel looked at these issues ten years after their approval through a desk review of the EIA and its implementation, and concluded that the impacts in construction and operation have not been significant. Interviews with fishermen, tourism industry representatives, public sector officials, and NGOs revealed that plant operations are not significant in local perceptions of impacts and problems.

Institutional Aspects

Because of the complexity of the issues at stake in Camisea, the challenges of environmental management are not derived only from a potential lack of capital. Several shortcomings and weaknesses were identified in the EIA process, with socio-environmental conflicts often arising from theses structural weaknesses. The EIA process in Peru has evolved into complex checklists which fall short of achieving their purpose of understanding and mitigating potential risks. Regarding participation and consultation, additional weaknesses were also identified. The "Prior Consultation Law" is an important step in the right direction and is currently in its early stages of implementation.

The Panel also attempted to determine whether community monitoring of extractive industry activities can be an efficient tool to help communities achieve a balanced relationship with the companies and to respond to community expectations regarding benefits and a cleaner, safer environment. The Panel identified five monitoring initiatives in Peru that involve local communities affected by the extraction of oil or gas. Three of these sites were visited for interviews. In all three cases, the local inter-community organizations were very interested in the idea of community monitoring, given their perception of environmental problems caused by the extractive activities and possible conflict arising over these incidents. Through the case studies and the critical review of a large body of laws, norms, regulations, and legal principles, the Panel has identified several clusters of ideas for enabling and improving the community monitoring process. The report pointed out the gap between the legal framework, which is positive and potentially enabling, and the absence of government institutions able to implement that framework. The report also pointed out that only one of the community monitoring efforts was financially independent; the other four were financed and overseen by the companies, limiting the independent use of the information gathered by the community monitoring program and the local community organizations, and thus reducing their usefulness as independent tools for conflict prevention.

At the regional level, government officials expressed interest in getting involved and supporting monitoring efforts. These same officials, however, are unaware of the existing monitoring initiatives and future possibilities. In general, the quality and capacity of municipal governments is very low. The Panel concluded that community monitoring of extractive industries can play a very constructive role and help improve relationships between communities and companies as long as these programs have the independence and channels to make their findings more widely available.

The Panel also studied the flow and distribution of the rents generated by Camisea at the sub-national level, including flows to regional governments and municipalities. Under the "Canon Agreement," 30 percent of transfers made to the Echarate District (where Camisea is located) from taxes and royalties (Block 88) are to be invested directly in public services and productive projects in indigenous communities.

In Echarate, direct transfers from the National Treasury have gone up exponentially from a low of US$1.2 million prior to 2003, increasing over 100 fold with an accumulated value between 2003 and 2013 of S/. 2.2 billion (US$800 million). Of this amount, 90% (US$750 million) comes from the Canon. The end result of these transfers is that, in Echarate, there has been a marked change in the source of funds for its budget. In the 2007-2013 period, a full 95 percent came from the Canon, gas royalties, and income tax. Despite these large transfers of financial resources, budget execution has been hampered by local authorities' lack of capacity in public management. After each election cycle (for example in 2010), budget execution drops by over half, since new authorities need to learn anew how to manage the municipality. The main investments were in transport (roads and bridges), water and sanitation, agriculture, education, and energy. Some of these investments in local roads, in the absence of a comprehensive planning framework at the regional level, threaten to undo the gains from the "roadless hydrocarbon" model described above by opening new and unplanned roads to access forest areas.

Total invested funds in Echarate amounted to S/. 1.3 billion (US$464 million), invested primarily by the Echarate Municipal Government (96 percent of the total), as opposed to the national or regional governments. These investments, as mentioned earlier, lack proper technical and planning controls. Only US$190 million of the expected US$225 million has been invested in indigenous communities. As determined in the previous sections, these funds have very little to show in terms of human development.

Social Aspects

The Panel studied social issues related to fishing communities on the coast and indigenous communities in Camisea.

Studies focused on fishing communities around the Peru LNG Project port terminal, and fisheries between Cerro Azul and Tambo de Mora. The Panel found that the number of registered fishermen and artisanal fishermen's social organizations (OSPA) within the area of influence of the Peru LNG project rose several fold after the construction of the terminal. Several hypotheses were set forth, but none conclusively. Fishermen perceive a decrease in the size and number of fish stocks, and some official data seem to suggest a decline in the number

of species currently caught. Nonetheless, the official data is not sufficiently complete and rigorous to confirm or reject this conclusion. The data being collected by the BMAP will help clarify the status of marine biodiversity and populations.

A compensation program for registered fishermen was put in place by the Peru LNG project in 2007, and a differentiated scale of payments was applied depending on distance from the Peru LNG loading port at Melchorita. Despite these payments, there continues to be some discontent and resentment among some fishermen over how this compensation was provided.

On indigenous issues, and based on an initial field visit to Camisea in 2012, a number of major areas of local concern were identified as the focus of the Panel's research: a universally noted decline in fish and game stocks; dissatisfaction with the education system; health status and health services; and the effectiveness and sustainability of social investments.

Fishing is a fundamental aspect of the diet, lifestyle, and food security of Amazonian populations, both indigenous and mestizo. The Panel summarized the results of a 2005 study (unpublished until recently), as well as a follow-up field study of the same region and some of the same communities in 2012 and 2014. The 2014 results showed a marked difference with 2005, with a diminishing catch but also a strengthened engagement in fishing for commercial purposes as opposed to subsistence. Increasing demand for commercial fish in urban centers such as Sepahua is a major factor. More generally, the Panel noted a lack of any serious oversight, organization, or study of fisheries in the region with a view to long-term management, as there is currently no plan in place to manage or increase fish production in the Lower Urubamba. Aquaculture projects, though meeting with a certain degree of success elsewhere in the Amazon, have been poorly implemented here to date. Several community projects have been installed by various institutions, but none appear to have proven sustainable or even minimally productive.

The Panel also summarized the current school system for indigenous communities of the Upper and Lower Urubamba, discussed the historical, territorial, and cultural context of indigenous education in this region and in Peru, provided field observations and interviews with teachers conducted during a visit to ten communities of the Lower Urubamba, and analyzed the results of a two-day-long participatory diagnostic workshop on education carried out with community leaders and educational administrators from the region. The educational system suffers from an internal lack of definition as to the nature and goals of bilingual intercultural indigenous education, the consequence of an administrative education system that is not well-adapted to the local cultural and geographical conditions.

Regarding health, its status among the Matsigenka depends upon tightly interwoven cultural, environmental, epidemiological, economic, and historical factors. The Panel identified data on common health aspects and arrived at a snapshot of the evolution of basic health indicators over the course of recent decades. Some patterns clearly emerged: chronic infant malnutrition remains high, with 59 percent of children suffering some form of malnutrition—41.2 percent exhibiting chronic malnutrition, 11.7 percent acute malnutrition, and 8.8 percent global malnutrition, as defined by World Health Organization standards applied to height/weight/age measurements. While child nutrition has tended to decline over the past twenty years, or at the very best, remained stagnant, adults already paradoxically appear to suffer from the negative impacts of over-nutrition brought on by the consumption of sugar and other processed foods.

In the Panel's 2014 study, out of the 21 children under 5 whose vaccine cards were available, and despite high coverage (90-100%) for important vaccines such as BCG, polio, and yellow fever, some worrisome gaps exist, including a low rate of coverage for measles (31.6 percent), a very low rate of initial vaccination at birth for polio, and some inconsistencies in the recommended follow-up doses of DPT and hepatitis B.

Community water and sanitation projects were found to be grossly inadequate. At best, current water systems pipe untreated stream water with moderate to high degrees of fecal coliform contamination straight to households. One community visited was constructing cell phone towers, even though it did not yet have clean drinking water in its taps, an example of how development priorities have gone seriously awry in some areas.

One particularly stark illustration of the inadequacies of the health care system in native communities was a rabies epidemic in 2012, apparently transmitted by blood-sucking bats that swept through the community of Camaná (along the main TGP pipeline route), killing seven children. The coincidence of this wave of deaths soon after a pipeline leak near their community made many people suspect that the two episodes were somehow related, reinforcing indigenous peoples' overwhelmingly negative perception of the trickledown social, health, and environmental impacts they are experiencing.

The sorry, declining state of indigenous health and community sanitation structures in the Lower Urubamba is simply not acceptable given the wealth that Camisea has generated in all sectors of the Peruvian economy, and the hundreds of millions of dollars that have entered local and regional governments' coffers over the past ten years, as explained above. The problem is no longer a matter of money or even technology or expertise, but mostly of adequate planning

and oversight. Large amounts of money have been invested without adequate strategic planning or oversight, yielding modest results, if any.

Without independent and transparent monitoring procedures, and with apparently no adequate baseline community resource studies, there is little hope of understanding ultimate causes and responsibilities. As mentioned in the section on regional and local development, the Municipality of Echarate is currently one of the wealthiest in Peru in terms of total income due to huge Canon royalty investments, yet this wealth has not filtered through to the local inhabitants of Camisea.

Conclusions

These building blocks allow us to make out a broader picture that is emerging for Camisea. The most important conclusion is that Camisea has produced measurable, large, and very positive macroeconomic benefits for the country, including major contributions to competitiveness through the supply of cheap energy, with the resulting major contributions to economic growth and poverty reduction. The environmental aspects are also positive. The project has helped reduce greenhouse gases from energy and land sources. The model of "roadless" hydrocarbon development has resulted in negligible deforestation in fragile Amazonian ecosystems, new marine habitats have been created through export facilities, and capacity-building opportunities have been seized through the BMAP.

Institutionally, the Panel identified weaknesses in the EIA process and the public sector at all levels. In particular, there is an evident lack of competent public administration at lower levels which leads to wasted funds and opportunities. Since the lion's share of royalty funds flowing to the Regional Echarate Government are being invested in roads and other transportation infrastructure, it remains to be seen whether this "roadless" model of hydrocarbon development will be maintained over the long run by government agencies. Oversight and government policy in this area will be critical to maintaining the positive legacy of Camisea in terms of deforestation in the future.

The main weaknesses identified are related to development opportunities for indigenous peoples in Camisea, who have not benefited and may be worse off than before in terms of health, nutrition, education, and overall perception of wellbeing. Infrastructure investments in native communities have suffered from a serious lack of planning, quality control, and oversight.

From a longer-term historical perspective, and in the context of the "boom and bust" cycles that have characterized the history of natural resource exploitation in Peru, so far history has not

repeated itself, although the country is very much still in the "boom" stage of the cycle. Peru must continue to make efforts to develop Camisea properly, ensuring that its benefits accrue for all segments of society.

Peru LNG is a project that has been executed following the strictest environmental and social standards, and has introduced numerous instances of best practices with long-term capacity building elements. Peru LNG, however, depends directly on gas transported by the existing TGP pipeline, where native communities in the Camisea have been able to benefit from the kinds of improvements to wellbeing that they expect and deserve. The success or failure of social and economic development in South-Central Peru will be judged as a whole.

Looking forward, gas has become crucial for economic growth and competitiveness but, depending on the assumptions, it will run out in about a decade unless more gas is found. This creates a "snowball effect" in which the weaknesses identified in this report will multiply unless they are effectively addressed in future projects.

Clearly, these future projects must learn from the Camisea experience, and introduce the best practices and positive lessons from Peru LNG. Equally important is the institutional fabric, which must be strengthened, especially at the local levels, as a matter of great urgency, with a special focus on improving wellbeing, in the broadest understanding of this term, in the native communities most directly affected by gas extraction activities.

Introduction

The South Peru Panel and Its Scope of Work

This consolidated report summarizes the results of the first five years of work of the Independent Advisory Panel on Development Issues in South-Central Peru (The Panel). The Panel was formally established at the end of 2009 to advise the Export-Import Bank of the United States (Ex-Im Bank) and other interested parties on the environmental and social effects of development in South-Central Peru in the context of the Peru LNG project (see Annex I for a complete description of the Panel, its history, and objectives).

After five years of work, a clear "picture" is emerging about exactly what Camisea has meant for the country. More importantly, the findings and lessons presented here have broad applicability within Peru and elsewhere with regard to challenges and opportunities for developing hydrocarbons responsibly in the context of fragile ecological and social environments. The Panel has thus decided to publish this consolidated report in the form of an initial summary of its work to date, based on more than a dozen supporting studies and preliminary reports that it has produced since 2011. A list of these reports is given in Annex 2.

Although the Panel was established in the context of the Peru LNG project only, its broad Terms of Reference allowed it to conclude that it is not possible to objectively separate the Peru LNG Project from the larger context in which it operates. Peru LNG is part of a much larger series of hydrocarbon-based projects centered on blocks 56 and 88 in Peru, known broadly as Camisea. Because these projects are so closely interlinked and interdependent, it is difficult to separate the wider social and environmental impacts of one from the others. Combined, these projects directly impact areas within the Departments of Cuzco, Ayacucho, Huancavelica, Ica, and Lima. Thus, the geographic scope of the Panel includes the greater South-Central Region of Peru.

The South-Central Region of Peru

Our choice and analysis is based on the enormous natural resources existing in South-Central Peru, which includes important reservoirs of oil, gas, minerals, hydropower, land, and timber. As a result of a favorable policy environment for investment over the past two decades, there has been an investment boom in natural resource extraction and infrastructure development in the region, of which Camisea and Peru LNG are just one among many players. Investments in resource extraction are also driving new accompanying investments in large infrastructure, such as new roads and hydropower generation. In turn, new public infrastructure facilitates

and encourages additional investments in natural resource extraction. Therefore, the Panel has chosen to take a wide thematic view of the region, addressing multidisciplinary and cross-cutting issues related to the economic, financial, social, environmental, ecological, and ethnic consequences and opportunities triggered by these events.

The geographic areas covered by the Panel closely match ecological realities and historical events that have shaped the social characteristics of the people living there, as well as their interactions with the environment and natural resources. For these reasons, we believe that defining the scope of the Panel as "South-Central Peru" is not arbitrary, instead reflecting a distinctive on-the-ground environmental, political, economic, and social reality. With the exception of Ica, the departments of "South-Central Peru" differ dramatically from Peru's national socioeconomic averages in many respects, as explained in the first Panel Report (2010).

There are three noteworthy ecological and social regions within the direct influence of the Camisea Project: (i) the rainforest of the Lower Urubamba Valley in the Urubamba Basin, recognized as an important global biodiversity "hotspot" because of its biological richness, high number of endemic species, and the presence of threatened species; (ii) the highlands area (Provinces of Huaytara, Cangallo, Huamanga, and La Mar, in the Departments of Huancavelica and Ayacucho, respectively), with representative Andean ecosystems; and (iii) the Paracas National Reserve, located on the coast south of Pisco, which is Peru's only marine reserve, with part of Paracas Bay listed as a RAMSAR site (1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat and Reserve) and considered of ecological importance because it contains representative samples of natural formations and biological diversity (mostly fauna) found only in the Subtropical Pacific Deserts and the Warm Temperate Pacific Deserts of Chile and Peru.

The region is also home to a wide diversity of indigenous peoples at various degrees of integration (or isolation) from the national and global economy, including the Matsigenka, Nanti, Ashaninka (Campa), Piro (Yine), Mashco-Piro, Nahua (Yora), Huachipaeri, and Amarakaeri.

The region is therefore notable for the presence of some of Peru's largest and most important natural protected areas and indigenous-occupied territories, including the Manu Biosphere Reserve, Otishi National Park and adjacent Matsigenka and Ashaninka Communal Reserves, the Upper Purus National Park, the Kogapakori-Nahua Indigenous Reserve, and a large block of approximately 1 million ha of titled indigenous communities along the Urubamba, Madre de Dios, and Upper Ucayali Basins.

Historical Context and Objectives of the Report

The Panel took a look at long-term issues that define the way Peruvian society interacts with its environment, addresses poverty, attracts foreign investment, and attempts to develop its South-Central Region. Given this large scope of issues, the Panel could only address specific issues in a relatively piecemeal fashion, while at the same time producing the building blocks for a larger picture that will eventually emerge. Over time, the Panel was able to gather information, identify sources of data, and interview key players to develop a proper understanding of the context in which these complex issues can be studied.

Peru's dramatic geography has been responsible for the abundant natural resources that have fueled its export sectors, such as guano, saltpeter (nitrates), and rubber in the past; and fisheries, mining, and timber today. Unfortunately, many of these extractive activities have left behind "boom and bust" cycles and have not been sustainable. Tragically, it is the presence of these rich resources and the boom and bust cycles they engender that, according to many, have prevented Peru from investing in its human capital or diversifying its economy: a typical case of the "Resource Curse" or "Dutch Disease."

Now that the rich gas fields of the Camisea region are finally under exploitation, it is crucial to make sure that history's lessons are applied in order to avoid past mistakes. Several fundamental questions arise:

- Is Peru using this historic opportunity to generate long-term economic and human development, as opposed to paying for short-term expenditures?
- What would be the best use of the gas revenues in order to aid the country's transition to a developed economy with higher quality of life?
- How is the wealth generated from Peru's gas distributed among its population, including its indigenous peoples?
- Has Camisea been developed in an ecologically sustainable manner?; and
- What are the broader lessons from Camisea for hydrocarbon development in fragile environments?

In short, has the country been able to develop Camisea in an economically, socially, and environmentally sustainable manner? This is the central question that this report seeks to answer.

Description of Peru LNG and Camisea

The Peru LNG Plant

With an investment of nearly US$4 billion, the Peru Liquefied Natural Gas Project, or PERU LNG (also known as Camisea II), was the largest foreign direct investment in Peru's history at the time of its approval, and the first LNG export project in Latin America.

PERU LNG is a Peruvian company created in 2003 for the purpose of exporting gas from Camisea as liquefied natural gas (LNG) to markets in Central and North America. Its majority shareholder and operator is Hunt Oil, a company headquartered in Texas and one of the world's largest independent oil and natural gas companies. Its partners at the time of approval were SK Energy of South Korea, Repsol YPF of Spain, and Marubeni of Japan.

The PERU LNG Project includes three components: (i) a gas liquefaction plant located on the coast between Cañete and Chincha, at Km 170 of the Pan-American Highway south of Lima; (ii) an adjoining Marine Terminal from which LNG is shipped overseas; and (iii) a 408-km-long pipeline, connected to the existing TGP (Transportadora de Gas del Peru) pipeline at a point in the mountains of Ayacucho, which connects Camisea to the LNG Plant.

The PERU LNG Project was planned to be carried out with a heavy focus on the introduction of cutting-edge environmental engineering, minimal ecological impact, sensitivity to cultural heritage, efficiency in communities' redressing needs and complaints, and a treatment and shipping facility that meets or exceeds the highest international standards.

Brief History of Camisea

The natural gas industry in Peru was not highly developed before Camisea. In the run up to the exploitation of this project, the natural gas industry was modestly present, mainly in two zones: the Aguaytia deposit in the central Amazon; and the set of fields located on the north coast. In the north of Peru, gas deposits are located in Piura and Tumbes and are associated with oil production. Before Camisea, market development had limited production and thermal electricity was restricted by competition from hydroelectric plants. The proven reserves in these fields total 0.262 TCF, which limits the possibilities for large-scale exploitation for regional or domestic market supply.

In July of 1981, Shell (as explorer and producer) signed a contract for oil operations in southern Peru's Blocks 38 and 42. Subsequently (between 1984 and 1988), the company discovered natural gas in Camisea, particularly in the fields of San Martin, Cashiriari, and Mipaya. In

March 1988, an agreement was signed between PETROPERU and Shell for the exploitation of natural gas, with an estimated investment of US$2.5 billion. The negotiation of the final contract was cancelled five months later because of a lack of government funding, as Shell's involvement occurred at a time when there was significant government involvement in the electricity and hydrocarbon sectors.

In the early 1990s, an agreement was signed between PERUPETRO and Shell International Petroleum to evaluate the commercial potential of the reserves of the three fields discovered, and in 1996, a 40-year license agreement was signed, through which the country gave the consortium of Shell and Mobil the right to exploit Blocks 88A and 88B. After the first stage of the project in July 1998, however, and following lengthy negotiations, the consortium decided not to continue with the second stage of the project due to the expected modest financial returns. There were additional factors cited by various sources, including a lack of consensus about the rate for electricity generation, authorization on vertically integrated distribution in Lima, and the government's refusal to allow the export of gas to Brazil.

In February 2000, the operation, separation, and fractioning of hydrocarbons for a period of 40 years was awarded to a consortium of PLUSPETROL, Hunt Oil, SK Corporation, and Hidrocarburos Andinos. The second phase for gas transmission and distribution over a 33-year period was awarded in October 2000 to a consortium led by Techint of Argentina, PLUSPETROL, Hunt Oil, SK Corporation, Sonatrach, and Graña y Montero of Peru. This consortium later formed the company Transportadora de Gas del Peru (TGP). In May 2002, natural gas distribution in Lima and Callao was transferred to Tractebel (SUEZ Group Belgium), which then formed the company Gas Natural de Lima y Callao SA (GNLC).

Economic Aspects of Camisea

For the study of the economic aspects of Camisea, the Panel's work included: (i) modeling future gas production and consumption under various demand scenarios; and (ii) a macroeconomic study of the benefits from Camisea.

The "Gasification" of the Peruvian Economy

The most obvious impact of Camisea on the Peruvian economy has been its rapid "gasification." Gas use for electricity generation has increased from less than 1% in 1996 to over 60% in 2014. Additionally, direct use of gas has also grown dramatically in industry and transport.

To better understand future trends in gas demand, various scenarios were built using the expected growth in demand for electricity, hydrocarbons, and natural gas, as published by the Ministry of Energy and Mines in its 2008–2018 National Baseline Electricity Plan and its 2009–2021 National Baseline Hydrocarbon Plan.

The baseline scenario contemplated new generation from future hydroelectric and thermoelectric plants (both single and combined cycle) through 2040. It also included the supply of electricity through non-conventional renewable energy sources to cover 5 percent of the total electricity demand, as mandated by Peruvian policy. Of this 5 percent, the scenario considers that 80 percent will be generated by wind energy, 10 percent by photovoltaic energy, and the remaining 10 percent by biomass. On the supply side, the model included projects with concessions already awarded in the 2010 and 2011 auctions.

These scenarios use the proven gas reserves as published by the MINEM, which primarily considers Blocks 56 and 88 in Camisea. In addition to these proven reserves, there are those located in Aguaytia and on the north coast (Piura). We included both the proven natural gas reserves (gas that is separated in the separation plants after being extracted from the wells), as well as the liquid reserves (liquids that are separated from the gases in the separation plants) that later provide components in the LNG fractioning plants. In total, these proven reserves come to 12.46 TCF of natural gas and 657,968 barrels of natural gas liquids.

Once these proven reserves have been estimated for the base year, it is assumed that there will be no further increases in proven natural gas reserves. Although this assumption is highly unlikely, it has been used so that the results can be compared methodologically under the various scenarios.

The main result is that, considering the projected demand of natural gas in the baseline scenario, the proven natural gas reserves (including liquids) will be sufficient to meet demands through 2021 only. Additional results are shown below:

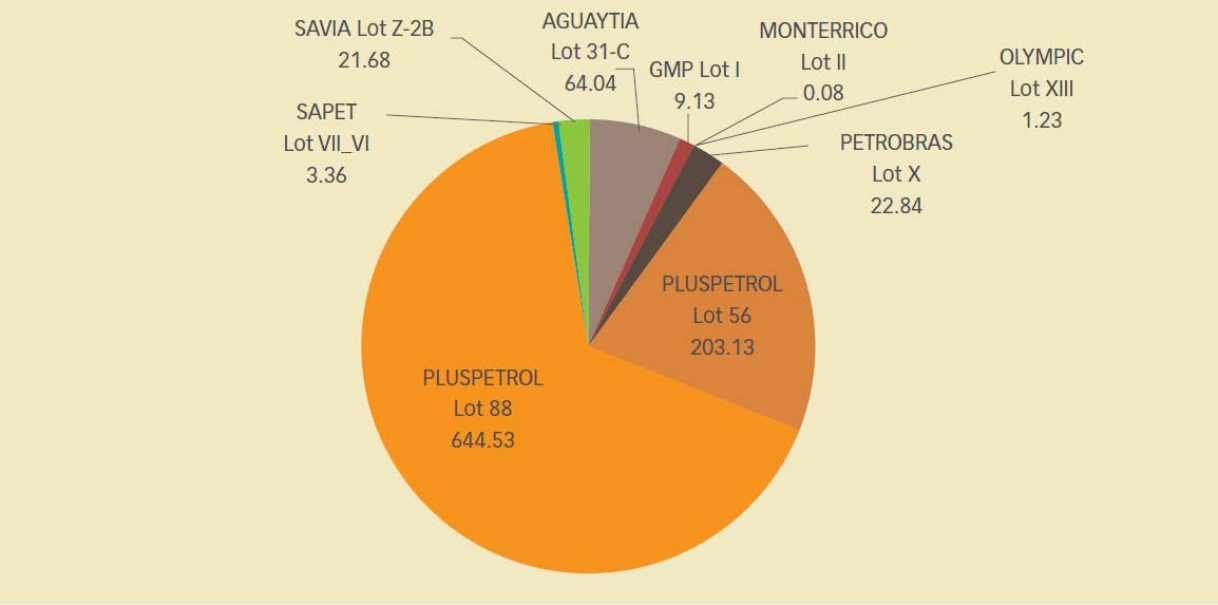


Figure 1: Total National Natural Gas Production 2009-2010 (MMSCFD)

a. The most favorable scenario from an environmental perspective is a theoretical "veto of electricity generation using natural gas," which produces the least greenhouse gas emissions, and also requires the lowest capital investments. This scenario assumes an aggressive development of new hydroelectric projects, ideally on the coast and in the Andes at an altitude of over 2,000 meters to avoid the negative environmental and social impacts of developing large hydro projects in the Peruvian Amazon.

b. In the energy efficiency scenarios, the cost of reducing CO_2 emissions through the implementation of energy efficiency policies is fairly conservative at US$9/ton CO_2.

c. Unless new reserves are found, the proven natural gas reserves will only last until 2021, assuming a conservative GDP growth of four percent per year. Even if, in the next few years, ten percent of possible reserves and fifty percent of probable reserves become proven, gas supply can be stretched to the year 2025 at the most. Furthermore, if policies were introduced to prevent natural gas from being used for electricity generation, the supply would only last through 2026. Such a scenario will require the aggressive implementation of policies to promote the development of additional hydroelectric projects.

Any attempt to develop new non-conventional renewable energy sources, however, requires the development of additional transmission and distribution networks, particularly considering the deployment of additional wind sources. Such costs are quite considerable and have not been taken into account in this analysis.

Macroeconomic Benefits

The main challenges that the Panel faced in estimating the macroeconomic benefits derived from the Camisea was the dispersion of data over different sources, under various formats, and in many cases without temporal continuity. Additionally, low availability and continuity of economic data in Peru reduces the opportunities to contrast project activities with their economic effects. The study nevertheless estimated the effects of the project in five crucial areas of public debate:

- How has Camisea affected energy generation costs?
- What have been the savings in transport costs as a result of Camisea?
- How do Camisea's activities affect Peru's trade balance?
- What would be the economic effects of a sudden halt in the Camisea gas supply?; and
- What are the effects of Camisea on employment?

To answer these questions, we used a wide range of data sources and assumptions about how economic agents would have behaved in the absence of Camisea.

Energy Generation Costs

In 2012, Peru produced 7 GW of electric power per year, and because of a high rate of economic growth, demand for electricity expanded at around 6.8 percent per year over the last 5 years.[1] Natural gas has been playing a growing role in this activity, increasing from 9 percent in 2004 to 37 percent in 2011.

As in many other markets, the price of energy is determined by its marginal costs. That means that electricity production is initiated with the cheapest available source. When a particular source reaches its maximum supply capabilities, the next most economical source is used. It is this growing cost at each production level that constitutes the supply curve of the market for electricity. Therefore, the factor that determines electricity prices is the most expensive alternative source, which in Peru is diesel fuel. To estimate the effects of Camisea on electricity generation costs, the Panel considered the following assumptions:

[1] These figures refer to 2012, the year when the supporting report was published.

Without Camisea, its share of electricity would be covered by diesel-run generation plants; and

- The cost of diesel is the value published by the Ministry of Energy for electricity generation.

Under these assumptions, savings are the difference between the amounts actually spent on Camisea's natural gas for electricity generation versus the amount that would have had to be spent on diesel to produce the same amount of energy. These savings are those accrued from the time Camisea began operations through 2012.

Applying a simple addition formula, the cumulative savings in electricity generation costs derived from Camisea totaled US$17.144 billion in the eight years between 2004 and 2012. These are very significant savings, with a marked impact on Peru's overall competitiveness.

Savings in Transport Costs

Camisea's most visible effect has been on Peru's transport system. At the end of 2012, there were 210 fuel stations that offered natural gas among their options and 156,000 vehicles fueled by natural gas. These hundreds of stations and thousands of vehicles in the streets of Peru are the most evidently visible effect of the Camisea project. Nevertheless, the real economic effects are not proportional with these visible effects. The Panel estimated the savings in transport as a consequence of Camisea based on the following assumptions:

- Without Camisea, the gas share in the transport sector would be covered by diesel vehicles, as diesel was the cheapest vehicular fuel before Camisea;
- Those willing to incur the conversion costs to natural gas are the most price-sensitive consumers; and
- The price of diesel is the yearly average of those published by the Ministry of Energy for electricity generation.

Savings are the difference between the amount actually spent on Camisea natural gas for vehicular fuel and the amount that would be necessary to spend on diesel derived from the conversion factor, accrued from the start of Camisea through 2012.

Based on this model, the Panel estimated US$756 million in savings. These savings are much less than those from electricity generation, even though the effects on transport are more visible. These calculations do not take into account the very significant environmental health effects, especially in Lima, which concentrates 204 of the 210 natural gas fuel stations in Peru.

Trade Balance Effects

Energy "independence" is an important issue in the public debate regarding energy, and is a popular argument aimed at increasing the "energy security" of a country, a belief anchored in a strong military presence in politics and based on the perspective of resistance in war and as a response to potential transport blockades.

The concept of energy independence remains relevant to some extent today because of its indirect effect on energy reliability, which translates to the need for reliable access to energy. Because of the high volatility of fuel prices, energy independence also implies a lower vulnerability to energy price shocks, which could have negative effects on a country's terms of trade.

To estimate the effects of Camisea on foreign trade, the Panel took two components into account. First, the higher level of exports resulting from Camisea, obtained from supply data to foreign markets. Second, the "import substitution" effect in fuel savings from a reduction in fuel imports, obtained by comparing the domestic supply from Camisea with the cost of an equivalent foreign fuel.

Applying an addition formula, the Panel estimated that Camisea has resulted in an accumulated difference of US$21 billion since it came into operation in 2004. Of this, 72 percent corresponds to import substitution. This has substantially reduced the Peruvian economy's risk exposure to international hydrocarbon price shocks.

The Economic Cost of a Natural Gas Shortage

As mentioned above, natural gas has become a critical input for the Peruvian economy. Thermoelectric plants fueled by natural gas produce 40.1 percent of Peruvian electrical power.[2] Of this, Camisea produces 96.5 percent, so it is easy to understand that a sudden halt in Camisea's capacity to supply gas would have a dramatic effect on Peru's economy.

Because of political and geographical factors, there is a not insignificant risk of a sudden halt in Camisea's activities, although such a halt could be the result of damage to the Camisea gas pipeline due to sabotage, terrorism, or a natural disaster (e.g., a strong earthquake or a landslide). There are three methodological challenges in any estimate of a sudden shortage in

[2] Based on 2011 figures.

energy supply: (i) a lack of historical records; (ii) the intrinsic complexity of the phenomenon; and (iii) unreliable data.

As explained earlier, since the time when Camisea began its operations, Peru has experienced a profound change in its energy source mix, with natural gas greatly increasing its share. There is no historical record of natural gas shortages or of national energy shortages lasting more than a few hours in Peru. A sudden shortage would have complex effects because of the way economic agents and the logistical disruption would have to act, and very accurate data is required to estimate such a complex phenomenon.

The Panel used the following method to resolve these difficulties: (i) we organized the different sectors of the economy according to their electricity intensity, calculated by the ratio between a sector's participation in electricity consumption over its share of the GDP, giving us a relative measure of the amount of electricity required to produce a unit of economic output; (ii) we assumed that sectors with higher energy use would suffer the most under energy shortages, since they will be the first to paralyze their activities in a shortage. The most resilient are those with low energy use. In other words, we assumed an efficient rationing system during the shortage.

There are two effects that are not considered: (i) the accommodation effects that will reduce the negative shock; and (ii) the logistics disruptions that will increase it. Since it is hard to estimate which of those two effects will be the greatest, we assumed that they would roughly cancel each other out.

Using this methodology, the Panel estimated that 28 percent of the GDP would be paralyzed if the Camisea supply was brought to a sudden halt. Should it be interrupted for two weeks, annual GDP would fall by 1.1 percent. This is probably in the low range of the real estimate, because of the considerable macroeconomic effects caused by lower investor confidence or sudden negative exchange rate shocks.

Employment Effects

Natural gas extraction and transport are among the most capital-intensive sectors of an economy, and are therefore considered to have few positive effects on it. The expression "economic enclave" is commonly used to refer to these projects, because it is assumed that there is no connection between such projects and the rest of the economy. This is especially true when considering effects on employment. This assumption is flawed, however, as it does not consider two effects aside from the direct ones: (i) employment generated by Camisea project suppliers

through their purchases (the multiplier effect); and (ii) induced employment created by the purchase effects of the income received by project employees.

To estimate the employment effect, it is necessary to apply the "input-output" matrix, which estimates the demand effect of each economic sector on the different sectors of the economy. If this matrix is combined with each sector's direct employment requirements, its demand effect on economic sectors may be associated with various levels of employment generation. Aggregating these jobs, the employment effect of each sector on the rest of the economy can be estimated.

The input–output matrix for the hydrocarbon sector shows that Camisea creates 56,798 jobs nationwide. This figure may underestimate Camisea's employment effect because of the static approach of this analysis, which does not take into account that lower and more reliable energy sources support Peru's long-term competitiveness, and the effect of this on investment and thus on employment.

In summary, the positive economic effects of the Camisea project on the Peruvian economy are extremely important and without precedent in Peru's modern economic history.

Ecological and Environmental Aspects

The Panel assessed the following ecological and environmental impacts (both positive and negative) of Camisea: (i) Amazonian deforestation; (ii) greenhouse gas emissions from deforestation; (iii) biodiversity and its monitoring; and (iv) marine ecosystems.

Deforestation

A study was prepared to analyze the ecological impacts of hydrocarbon exploration and exploitation without roads (the "roadless" or "offshore-inland" model) in the Peruvian Amazon, a concept advanced by former U.S. Secretary of the Interior Bruce Babbitt.

From the perspective of the ecological integrity of the Amazon Basin, avoiding loss of forest cover (a.k.a. deforestation) is the most important principle for reducing ecological impacts and loss of biodiversity. Forests provide biodiversity habitats and numerous services to ecosystems and societies; the loss of forest cover seriously erodes these functions and is the first step in a chain that eventually creates a situation where habitats are lost, soils are destroyed, ecosystem functions cease to exist, and biodiversity is seriously impacted.

The study therefore focused on direct deforestation (and resulting emissions of greenhouse gases) caused by hydrocarbon development, and compared it with alternative forms of land settlement and economic activities in the Amazon. It is already widely accepted that in recent years, hydrocarbon development activities in the Peruvian Amazon have been causing less deforestation in comparison with other economic activities that cause an intensive and rapid change of land use, mainly due to the fact that national environmental regulations for the hydrocarbon sector encourage accessing installations by river or air, avoiding opening up new roads, and thus limiting deforestation.

Research included five study areas within the Peruvian Amazon selected for their main economic activities, including: (i) two areas where hydrocarbons are exploited (Oil Blocks 1-AB and 102 in the Department of Loreto; and Oil and Gas Blocks 56 and 88 in Camisea); (ii) cattle ranching in the "Codo del Pozuzo" in the Department of Huánuco; (iii) artisanal mining in Huaypetue, in the Department of Madre de Dios; and (iv) the oil palm industry in Caynarachi, in the Department of Loreto.

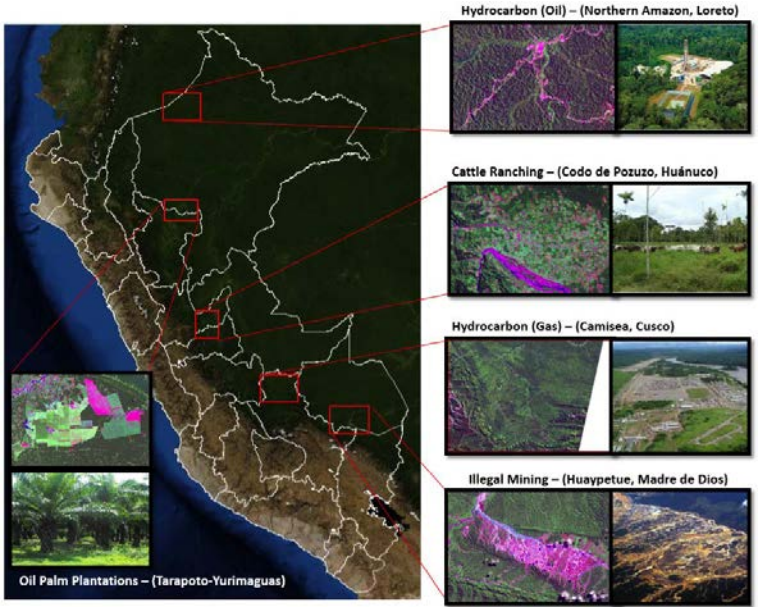


Figure 2: Study Areas

Forest loss was more intense in the case of livestock (Codo del Pozuzo), where agriculture has expanded considerably and forest has been turned into pastureland, with an average annual deforestation of 1,508.8 ha/year and an annual deforestation rate of 2.09 percent. This was the area that suffered the highest total deforestation during the period analyzed.

Oil palm plantations were also responsible for very significant deforestation. In the case of the areas comprised in the Tarapoto – Yurimaguas corridor, the study found a forest area in 1999 of 38,975 ha, which was reduced to 21,687 ha in 2011, representing a loss of 17,288 ha for the period, equivalent to 34.8 percent of the study area.

In the case of illegal and artisanal mining, deforestation is clearly visible through satellite images. The study area includes the Huaypetue and Puquiri Rivers in Madre de Dios, with a total area of 114,842 ha. The area was defined exclusively for this study and does not reflect any official demarcation. The study area in 1986 had forest cover of over 94,759 ha, reduced to 87,378 ha in 2006, representing a loss of 7,381 ha, equivalent to 10.5 percent of the study area.

Oil exploration in the northern Amazon region had a forest cover of 392,304 ha, reduced to 391,605 ha in 2006, reflecting the loss of 698 ha over the period, equivalent to 0.17 percent of the study area.

The lowest deforestation was found in Gas Blocks 56 and 88 (Camisea), which corresponds to the roadless hydrocarbon model, with an average annual deforestation of 2.25 ha/year and an annual deforestation rate of just 0.001 percent.

Table 1 and Figure 4 below present a summary of the results. The differences are striking: most traditional models of economic activities in the Peruvian Amazon produce very high rates of deforestation, which, in the case of palm oil, can be as high as 4.77 percent per year. At the other end of the spectrum, hydrocarbon activities without roads produce the lowest deforestation, which for all practical purposes can be considered negligible in the case of Camisea. The Panel notes that Blocks 88 and 56 were already titled to Matsigenka communities before Shell began exploration in Camisea, and this played an important role as well.

Table 1: Forest Cover and Deforestation Rate in the Case Studies Presented

Economic Activity	Zone	Assessed Period (Year 1 - Year 2)	Study Area (ha) 1/G	Forest in Year 1 (ha)	Forest in Year 2 (ha)	Annual Deforestation Rate in % 2/
Hydrocarbon (Oil)	Loreto	2001-2006	406,659.15	392,304	391,605	0.04%
Hydrocarbon (Gas)	Cuzco	1986-2005	200,711.34	188,540	188,497	0.00%
Illegal Mining	Madre de Dios	1986-2006	114,842.61	91,759	87,378	0.40%
Cattle Ranching	Huánuco	1994-2001	106,212.06	84,996	59,346	2.09%
Oil Palm Plantations	Loreto	1999-2011	49,735.44	38,975	21,687	4.77%
1/ The study area includes forest and non-forest covers, as well as other land covers such as water, riverbanks, and sections without data (clouds and shadows).						
2/ Deforestation rate calculated by comparing the areas with forest cover in the same region (study area) at two different points in time (Year 1 and Year 2), expressed in % (FAO, 2005).						

Source: Ecosystem Services, 2013

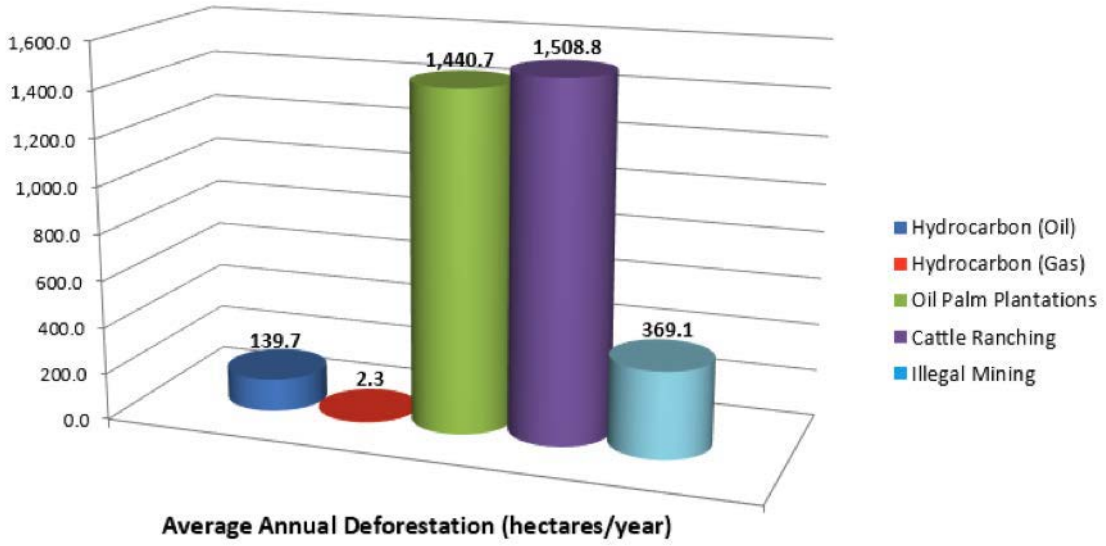


Figure 3: Average Annual Deforestation (hectares/year)

One of the most important development challenges faced by tropical countries with large forest areas is to create economic development opportunities without destroying forests. This study demonstrates that most traditional economic activities result in massive deforestation, with the consequent loss of biodiversity and ecological functions. In the case of illegal mining, these effects are compounded by the irreversible loss of soil and very serious pollution effects with impacts on human health. Similarly, cattle ranching unleashes a well-known cycle of deforestation and settlement followed by abandonment due to the very poor soils found in the Amazon.

The Panel notes that other forms of environmental damage in hydrocarbon activities (i.e. oil spills and other accidents) may have negative impacts in some cases. The presence of strong property rights because of the existence of titled indigenous communities also prevents deforestation.

For the most part, however, in contrast to these unsustainable models of territorial settlement, the roadless hydrocarbon model in Camisea provides a unique opportunity to generate very substantial wealth and economic growth as shown earlier, while avoiding negative ecological impacts. The Camisea project is an example of how such a development model can be implemented in the Amazon.

Greenhouse Gases from Deforestation

The study also converted the observed deforestation patterns to emissions of greenhouse gases due to the release of carbon dioxide into the atmosphere. These emissions result from the burning or decomposition of the carbon dioxide stored in the forest biomass after deforestation occurs.

GHG emissions are calculated based on deforestation data and IPCC standard values. As expected, annual average GHG emissions of hydrocarbons projects analyzed are much lower compared to other economic activities evaluated. Camisea had the lowest emission levels (an average of 1,431 T CO_2-eq/yr. from 1986-2005) compared to the other activities. Cattle ranching, with its rapid expansion, generates the highest GHG emissions out of the five cases (915,309 T CO_2-eq/yr. from 1994-2011), followed by palm oil crops (863,669 T CO_2-eq/yr. from 1999-2011) and artisanal mining (234,783 T CO_2-eq/yr. from 1986-2006).

Biological Monitoring

The Biodiversity Monitoring Program (BMAP) is a collaborative effort between the Center for Conservation Education and Sustainability (CCES) of the Smithsonian Conservation Biology Institute (SCBI) and the company PERU LNG, with the purpose of integrating biodiversity conservation aspects in the construction and operation of the PERU LNG pipeline, operations in the Melchorita processing plant, and the port terminal. This is a unique initiative of considerable scope. As such, the Panel analyzed its methods and protocols, best practices, and compared these with the regular monitoring protocols required by Peruvian legislation.

The BMAP works in fifteen landscapes or "ecological landscape units" (ELU) along the pipeline, which, as mentioned earlier, runs a distance of 408 km and crosses landscapes and ecosystems in three major ecological regions: mountain forests in the Chiquintirca area of the Department of Ayacucho; the Andean highlands (310 km), where it reaches its highest altitude of 4,900 meters above sea level; and the Pacific Basin, ending in the arid coastal desert area at the Melchorita Plant in Cañete.

The BMAP establishes long-term monitoring and evaluation protocols for species and habitats that are important for conservation. It also determines the ecological status of species and their changes over time in order to implement appropriate adaptive management responses to field conditions. The resulting biological assessments serve as guidelines for decision-making and for mitigating the project's potential impacts on biodiversity.

PERU LNG conducted several detailed ecological assessments of the Right of Way (RoW). Once data is available, a more comprehensive Biological Monitoring Plan is proposed to incorporate the critical components of each ELU. The BMAP includes all elements of the Biological Monitoring Plan approved in the EIA, but expands to cover all the key elements of biodiversity for this project.

The BMAP emphasizes the active participation of local nationals in fieldwork and research. To date, it has involved 104 principal investigators from Peru out of a total of 110, representing a participation rate of 94.5 percent for Peruvian researchers, including biologists from Lima, Arequipa, Cusco, Huancayo, Tumbes, Ayacucho, Loreto, Cusco, and Ica. This represents significant capacity-building for biological sciences in Peru.

The Panel found that the BMAP represents one of the most comprehensive biological monitoring efforts ever conducted in Peru. Several attributes that can be considered best practices in biodiversity monitoring are summarized in Table 2 below.

Table 2: Best Practices of the BMAP and Modes of Communication

Best Practices of the BMAP	Activity	Description
	Open channels of communication and feedback with Peru LNG management	1. Technical Reports using BMAP forms reviewed and approved by BMAP Director. These documents contain recommendations for monitoring improvement and for potential mitigation actions, if necessary. 2. Direct presentation by researchers of the main findings to PERU LNG Environmental Management, in coordination with the CCES. 3. Final report summaries with specific recommendations and monthly reports prepared by BMAP. 4. Direct communication between BMAP's director and PERU LNG management on those topics that require immediate attention.
	Capacity-Building	1. Direct involvement of Peruvian researchers in monitoring protocols. 104 principal investigators from Peru out of a total of 110, representing a participation rate of 94.5 percent for Peruvian researchers. 2. Researchers come primarily from provinces along the pipeline, and not just from Lima. 3. There is direct capacity support provided by the BMAP at the Smithsonian in Washington, as needed (the CCES-SCBI).

	Functional Ecological Studies	1. Protocols are based on the definition of important ecological processes that are identified and described, instead of simply collecting "species lists." 2. Protocols are dynamic and adapt to changing circumstances. 3. Protocols not only describe the potential impacts (diagnosis), but also define and implement proactive conservation activities for species of conservation concern.

Many of these practices go beyond the legal requirements established by the Peruvian EIA system regarding biological monitoring. Table 3 below summarizes the instances in which the BMAP surpasses the legal requirements defined by the Peru LNG EIA.

Table 3: Comparison of the Biological Monitoring Plan approved by the EIA and the Biodiversity Monitoring Program (BMAP)

Aspects	EIA Requirements	BMAP Practices
Baseline Information	2006: EIA Baseline (6 months of fieldwork). Random sampling within a 3-7 km wide transect.	- 2006: EIA Baseline (6 months of fieldwork). Random sampling within a 3-7 km wide transect. - 2007: First Ecological Evaluation (6 months of fieldwork). Random sampling within 50 m of the Right of Way. - 2008: Second Ecological Evaluation (8 months of fieldwork – both dry and rainy seasons). Total sampling within 25 m of the Right of Way.
Objective	Evaluate potential impacts.	Evaluate potential impacts and develop biodiversity plans.
Methodology	- Random sampling - Diversity and abundance - Transect at 0, 800 and 1,200 from the Right of Way	- Identify and categorize species of conservation concern - Define questions for each associated species regarding conservation concerns and potential project impacts - Specific protocol for each species, including detailed sampling methodology for each element - Definition of conservation actions and strategies

Taxonomic Groups to be Included	- Birds - Plants	- Birds - Plants - Mammals - Amphibians - Reptiles - Selected habitats
Frequency	Dry and rainy seasons	Dry and rainy seasons, AND periods of special concern or interest based on the species
Expected Outcomes	To show decrease in potential impacts as one moves away from the Right of Way	- Evaluate possible impacts of the operation and propose mitigation measures - Evaluate conservation status of priority species - Identify and describe new species to science - Define and expand distribution ranges for selected species - Systematized database for 14 ecological units - Identify and implement on-the-ground conservation strategies - Scientific publications

The BMAP exceeds the legal requirements of an EIA by establishing long-term ecological studies on distribution, abundance, and functional interactions of the project with the ecosystem, as opposed to simply putting together lists of species. This results in a better understanding of ecosystem functioning, and the potential project impacts upon it. The BMAP represents an example of best practice in biodiversity monitoring and in the application of a comprehensive EIA process.

Marine Ecosystems

The Panel started the basic characterization of the project's impacts on the marine environment by describing the marine biodiversity in the newly formed marine ecosystem at its export facilities at Melchorita, as well as analyzing some of the changes at the Paracas terminal. An attempt was made to study morphological changes in the marine environment south of Melchorita, but the results were inconclusive, and thus are not included here.

Peru LNG Plant

The physical infrastructure built in Melchorita, which includes a new large pier and a large artificial "island" (breakwater) to allow ships to uptake the liquefied gas, have created a new marine habitat which, by virtue of its protection, visibly provides habitats for numerous species. The objective of the study was to characterize the newly formed coastal marine ecosystem.

Methods included fieldwork by biologists throughout transects in and around the export facilities (May 2014); zoning of the newly formed marine ecosystems; identification and census of bird species; statistical analysis of results; review of the literature; and comparisons with similar natural ecosystems. The study are was subdivided into Blocks (Sectors) based on the predominance of specific habitats. Species of conservation concern were also identified based on specific criteria.

Although the lack of comparable baseline data does not allow for a full study on species or population trends, the following patterns emerged:

- Changes in beach morphology have enhanced feeding habitats for *ostreros* (Haematopus palliates) and *rayadors* (Rynchops niger), which seem to have increased,
- The main breakwater has provided new habitats for the establishment of large bird colonies of *piqueros* (Sula variegate), *guanays* (Phalacrocorax bougainvilli), pelicans (Pelecanus thagus), Humboldt penguins (Spheniscus humboldtii), and *chitas* (Phalacrocorax brasilianus).
- Total bird population is close to 5,000 individuals.
- There is no evidence of changes in habitats or feeding habits for the birds studied.

Photo 1: Typical view of the breakwater showing seabirds

The breakwater provides a very important breeding habitat for the Humboldt penguin, which is a threatened species. This habitat protects close to 500 individuals, estimated to account for around 10% of the entire Peruvian population. The main reason is that the physical export infrastructure has created an artificial ecosystem that is beginning, through ecological succession, to resemble a typical "guano island," the main habitat for numerous marine birds in Peru.

The Panel provided the following recommendations:

- It is critical to establish periodic monitoring protocols for keystone species as ecosystem indicators. Suggested species are: Spheniscus humboldti (conservation concern), Pelecanus thagus (conservation concern), Haematopus palliatus (specialized habits), and Leucophaeus palliatus (specialized habits).
- Study the reproduction habits of above species.
- Study and monitor plants, mammals, and trophic chains.
- Monitor rapid growth in guano bird populations and possible damage to port structures.

In conclusion, a highly diverse and rich marine ecosystem is developing. Its evolution needs to be monitored, and access to the reproductive areas of Spheniscus humboldtii and Pelecanus thagus needs to be restricted.

Paracas

The construction of the infrastructure for handling the liquids associated with Camisea in 2004 raised a number of environmental concerns related to the proximity of these facilities to the Paracas National Reserve and an allegedly fragmented EIA approval process. As a result, rigorous environmental conditions were introduced by the IDB and CAF, two of the main funders of these components of Camisea. The Panel looked at these issues ten years after their approval to understand the perceptions of local users and authorities, as well as to provide a first update on the environmental impacts of these structures. These issues are of great importance given the prominence of Paracas Bay, as follows:

- A major location for marine biodiversity, commercial fisheries, and tourism;
- It is a National Wildlife Reserve and a national reserve for guano;
- Its population has increased five-fold since 1940 (today, it is 111,000);
- It represents 12% of the national anchovy catch;
- It is important for 3,000 artisanal fishermen (800 boats);
- There are 11 fishmeal plants in operation, and 16 canning and freezing plants;
- There has been an increase in agri-exports and maritime traffic with the San Martin Port (recently privatized);
- Pollution from numerous sources has been growing.

The infrastructure on the beach includes a fractioning plant (propane and butane), a primary distillation unit (naphtha, diesel, and jet fuel), and thirteen refrigerated storage tanks. The infrastructure in the ocean includes a docking facility and trestle (3 km long). There has also been a continuous increase in production and storage and an 89.6% growth in hydrocarbon exports between 2008 and 2013, but only 8.5% growth in the number of vessels.

After a desk review of the EIA and its implementation, the main conclusion was that the impacts from construction and operation have not been significant. Plant operations are insignificant in local perceptions of impacts and in problems raised in interviews with fishermen, tourism industry professionals, the public sector, and NGOs. The consultant provided a series of recommendations, of which the Panel endorsed the following:

- Update the Strategic Plan for the recovery of Paracas Bay;
- Improve the quality and dissemination of information regarding the fractioning plant, especially that related to risks and protocols;

- Better integration, dissemination, and transparency of monitoring results for all local institutions;
- Encourage monitoring and participation on the part of the community;
- More involvement from the Regional Government of Ica, including independent socio-environmental evaluation addressing overlapping and contradicting rights and uses.

Institutional Aspects

EIA Process

Because of the complexity of the issues at stake in Camisea, environmental management challenges do not arise only from a potential lack of capital. The overarching question addressed is whether the legal and institutional framework in Peru is properly able to address two sets of issues: (i) environmental and social impact avoidance and mitigation; and (ii) strategic use of gas to fuel and sustain local, regional, and national economic and social development. Both sets of issues are explicitly addressed by the National Environmental Management System (SNGA).

The EIA process in Peru has evolved into complex checklists which, for the most part, fall short of achieving their purpose of understanding and mitigating potential risks. Through a desk review, the following shortcomings and weaknesses in the EIA system were identified:

- Potential conflict of interest within the sectors involved, where the same sector can promote investments but also approve environmental assessments;
- Limited institutional, financial, administrative, and logistical capacity for the approval of EIAs. A UNOPS consultancy to the public mining sector showed delays of five to six times the established statutory deadlines due to these reasons;
- Contents of the EIA are still insufficient to mitigate, minimize, and reduce impacts, with specific weaknesses including:
    - Lack of accurate knowledge of elements and socio-environmental impacts of the projects;
    - Lack of adequate criteria of inter-culturality and local realities, limiting the affected population's understanding of the EIA because it is often written in a different language or uses technical jargon;
    - Repeated approaches to biodiversity assessment and baseline studies, sometimes using transcripts of previous EIA studies ("copy-paste");
    - No timely access to EIAs according to deadlines;
    - Target populations often lack technical skills to respond in a timely manner; and
    - Failure to comply with periods for review (120 days).

Socio-environmental conflicts often arise from these structural weaknesses. In view of these potential problems, the Panel made the following recommendations:

- Strengthen environmental units with greater resources, qualified personnel, and adherence to EIA deadlines;
- The need to consider the synergistic and cumulative impacts of activities taking place in the same area;
- More complex analysis tools are required in the EIA, such as:
    - Detailed analysis of baseline studies on biological components, specifically requiring biodiversity factor analysis beyond inventories of flora and fauna, performing ecosystem and genetic analyses. The Panel notes that this recommendation has already been voluntarily implemented in the Peru LNG project through the BMAP;
    - Economic valuation of natural resources and environmental services based on cultural criteria;
    - More detailed analysis of social impacts (cultural, anthropological, and religious).

In terms of participation and consultation, the following weaknesses were identified:

- A generalized absence of the government and lack of planning processes;
- Limited information available to local people, especially indigenous peoples, about their rights and the benefits and the impacts of these projects;
- Constraints on meeting, discussing, and agreeing on environmental and social obligations assumed by the project owner through the EIA and other instruments of environmental and social management.

The Panel notes that the "Prior Consultation Law" is an important step in the right direction, and that it is currently in the early stages of implementation.

Community Monitoring

The Panel addressed the question of whether or not community monitoring of extractive industries can be a useful tool to help communities achieve a balanced relationship with private companies and to respond to community expectations regarding benefits from these activities and their aspirations for a cleaner and safer environment.

At the national and international levels, there is a body of principles and provisions that encourages community involvement in local monitoring, but the Peruvian government has been slow in taking advantage of these provisions. The few cases of community monitoring that the Panel found in the oil and gas industry are isolated. The Panel identified five monitoring

initiatives in Peru that involve local communities; three of these were selected for visits, interviews, and analysis, as follows:

- The Community Environmental Monitoring Program in the Lower Urubamba Valley (PMAC-BU), led by Pluspetrol (Block 88 in Camisea);
- The Community Environmental Monitoring Program in the Corrientes River Valley, where Pluspetrol is extracting crude oil and transporting it to the coast through the northern pipeline (Blocks 1AB and 8); and
- The Independent Territorial Monitoring Program of the Federation of Native Communities of the Corrientes Valley (PVTI-FECONACO).

In all three cases, the local inter-community organizations were very interested in community monitoring, given their perception of environmental problems caused by the extractive activities and possible conflict arising over these incidents.

The Panel concluded that a community monitoring effort under favorable conditions, which include the need for financial and management independence, can be a valuable tool for helping local communities, whether indigenous or not, to:

- Become more aware of their responsibility of caring for the local environment and its resources, learning how to exercise greater control over extraction, and better participating in the use of natural resources within their territories;
- Empower them to take action when a third party fails to comply with the law or to live up to its agreements; and
- Strengthen their capacity to negotiate when third parties are awarded specific rights that overlap with community rights.

Through the case studies and the critical review of a large body of laws, provisions, regulations, and legal principles, the Panel has identified several clusters of ideas for enabling and improving the community monitoring process:

- Within Peru, the idea and practice of community monitoring is very recent and not yet widely accepted. These processes need to be better institutionalized;
- When the extractive industry itself sponsors community monitoring, it could receive technical and financial resources for the sustainability thereof
- For the most part, the Peruvian government is absent from this process.

The report has highlighted the gap existing between the legal framework, which is positive and enabling, and the absence of government institutions with the political will to implement that framework.

At the regional level, government officials have expressed an interest in becoming involved and supporting monitoring efforts. These same officials, however, are unaware of the existing monitoring initiatives and future possibilities. At the provincial and district levels, lack of knowledge regarding these issues is overwhelming, although environmental legislation offers legal tools, including those for the Local Environmental Management System.

In conclusion, under the right conditions, community monitoring of extractive industries can play a very constructive role and help improve relationships between communities and companies. In this context, full independence is a key prerequisite.

Regional and Local Development

The Panel studied the flow and distribution of the income generated by Camisea at the subnational level, including flows to regional governments and municipalities. Under the "Canon Agreement," 30 percent of transfers made to the Echarate District (where Camisea is located) from taxes and royalties (Block 88) are to be invested directly in public services and production projects within indigenous communities.

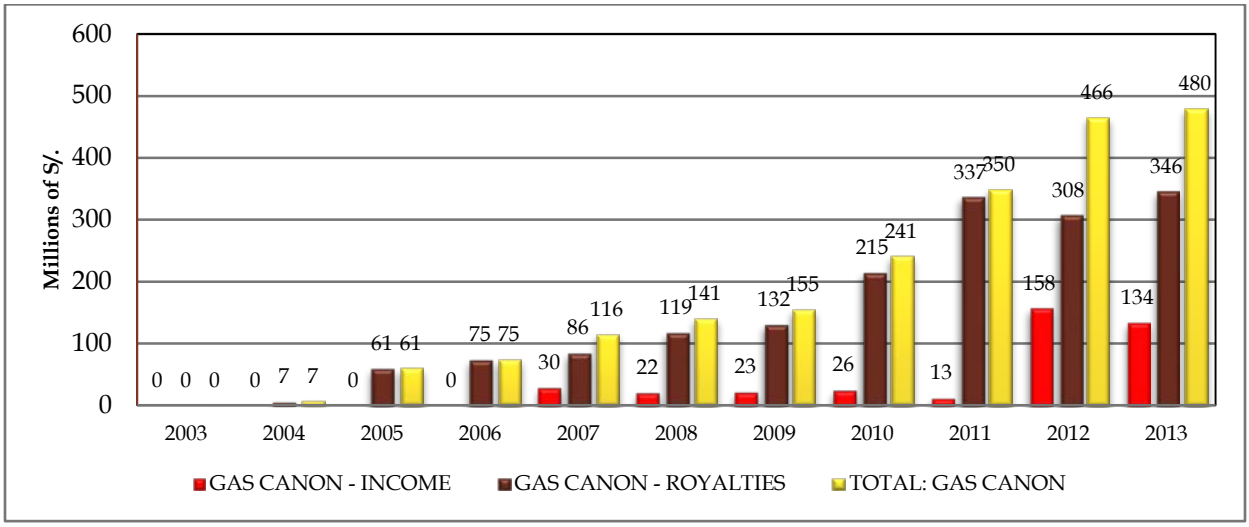
Initially, 2.1 TCFs from Block 88 (Camisea I) were directed to the Peru LNG project. On August 10, 2014, a decision was made that no additional gas from Block 88 would be used by Peru LNG, a campaign promise by President Humala. As of August 2014, therefore, transfers to communities were to be derived from income from Block 56 only (Peru LNG).

The objectives of this study were as follows:

- To quantify transfers to the Echarate District during the 2003-2014 period;
- To analyze the use of the transferred funds; and
- To examine projects and project execution in indigenous communities.

In Echarate, direct transfers from the National Treasury have gone up exponentially: prior to 2003, Echarate received a meager S/. 4 million (US$1.2 million) in transfers. Since 2004, transfers have increased over 100 fold, with a cumulative value between 2003 and 2013 of S/. 2.2 billion (US$800 million). Of this amount, 90 percent (US$750 million) comes from the Canon. Applying the "Canon Agreement" rule, a full US$225 million should have reached indigenous communities.
Royalties have also increased steadily every year, except 2012, as shown in Figure 4 below.

Figure 4: Echarate: Canon Transfers (2003-2013)



Source: Ministry of Economy and Finance (MEF). Prepared by: Instituto del Perú.

The end result of these transfers is that there has been a marked change in the source of funds in Echarate for its regular budget. In the 2007-2013 period, a full 95% came from the Canon, gas royalties, and income taxes.

Table 4: Echarate: Source of Funds in Annual Budget (2007-2013) in Millions of Soles

SOURCE OF FUNDS	2007		2008		2009		2010		2011		2012		2013	
	PIM	Share	PIM	Share	PIM	Share	PIM	Share	PIM	Share	PIM	Share	PIM	Share
Echarate	203.4	100%	262.8	100%	266.0	100%	288.2	100%	482.4	100%	835.4	100%	930.7	100%
Canon, Excess Canon, Royalties, Customs Duties	193.6	95%	250.5	95%	250.2	94%	272.1	94%	463.0	96%	814.1	97%	908.6	96%
Ordinary Resources	1.0	1%	1.3	1%	2.8	1%	1.5	1%	1.5	0%	1.5	0%	1.6	0%
Municipal Taxes	1.2	1%	1.1	0%	1.4	1%	3.1	1%	3.5	1%	3.4	0%	1.6	0%
FONCOMUN- Poor Districts	6.8	3%	8.2	3%	9.1	3%	8.7	3%	11.4	2%	13.2	2%	14.3	2%
OTHER	0.8	0.4	1.7	1%	2.6	1%	2.90	1%	3.0	1%	3.1	0%	4.6	0%

Source: Ministry of Economy and Finance (MEF). Prepared by: Instituto del Perú.

Despite these large transfers of financial resources, budget execution has been hampered by a lack of capacity among local authorities with regard to public management. After each election cycle (for example in 2010), budget execution drops by over half, since new authorities need to learn to manage the municipality. The main investments have been in transport (roads and bridges), water and sanitation, agriculture, education, and energy. Some of these investments in local roads, in the absence of a comprehensive planning framework at the regional level, can erode the gains made by the "roadless" hydrocarbon model described earlier by opening new and unplanned access to forests, with the resulting deforestation.

Table 5: Echarate: Execution of Annual Budget by Source of Funds (2007-2013) in Millions of Soles

SOURCE OF FUNDS	2007		2008		2009		2010		2011		2012		2013	
	PIM	Share	PIM	Share	PIM	Share	PIM	Share	PIM	Share	PIM	Share	PIM	Share
Echarate	203.4	49%	262.8	69%	266.0	82%	288.2	82%	482.4	33%	835.4	48%	930.7	79%
Canon, Excess Canon, Royalties, Customs Duties	193.6	47%	250.5	68%	250.2	83%	272.1	83%	463.0	31%	814.1	47%	908.6	79%
Ordinary Resources	1.0	99%	1.3	100%	2.8	99%	1.5	99%	1.5	100%	1.5	100%	1.6	100%
FONCOMUN-Poor Districts	6.8	83%	8.2	87%	9.1	75%	8.7	75%	11.4	75%	13.2	86%	14.3	95%
Municipal Taxes	0.8	58%	1.7	83%	1.1	50%	1.3	50%	2.2	84%	2.3	90%	2.2	91%
Other Municipal Taxes/Permits	1.2	65%	1.1	85%	1.4	72%	3.1	72%	3.5	45%	3.4	84%	1.6	78%
DONATIONS AND TRANSFERS	0.0	0%	0.0	100%	1.5	1%	1.6	1%	0.8	26%	0.8	18%	2.4	31%

Note: Advance (%) money effectively given/money budgeted

Source: Ministry of Economy and Finance (MEF). Prepared by: Instituto del Perú.

Funds invested in Echarate amounted to S/. 1.3 billion (US$464 million), invested primarily (96 percent) by the Echarate Municipal Government, as opposed to the national or regional governments. These investments, as mentioned earlier, lack the proper technical and planning controls.

The Panel reached the following conclusions:

- At the national level, the Ministry of Finance has played a "behind the scenes" role once funds are transferred to the Municipality of Echarate;
- There are no clear protocols or priorities for the allocation of investments at the municipal level;
- Many projects are over budget due to lack of oversight and poor management quality;
- Only US$190 million of the expected US$225 million has been invested in indigenous communities. As determined in the previous sections, these funds have very little to show in terms of human development.

The Panel provides the following recommendations:

- There is a need for a protocol for prioritizing investments in indigenous communities;
- This protocol should be discussed with the Ministry of Finance and the National Ombudsman's Office ("Defensoría del Pueblo");
- If developed, such a protocol would need to be discussed and validated with the indigenous federations.

Social Aspects

The Panel studied localized social issues, including those found in fishing communities on the coast and indigenous communities in Camisea.

Fishing Communities on the Coast

The Panel studied fishing communities around the Peru LNG Project port terminal, and fisheries between Cerro Azul and Tambo de Mora. Artisanal fishing, fishermen, and their communities are among the least visible sectors in Peru and are the lowest priority for government services. This is reflected in the poor quality of official data about them, the scant government spending on their community needs, the lack of attention they receive from government and Peruvian researchers, and the minimal effective protection for their fishing areas. Thus, a lack of reliable data was a major obstacle to this work.

Nevertheless, the Panel found that the number of registered fishermen and artisanal fishermen's social organizations (OSPA) within the area of influence of Peru LNG had risen several fold since the construction of the terminal. Several hypotheses were advanced, but none conclusively.

Fishermen perceive a decrease in the size and number of fish stocks, and some official data seem to support a decline in the number of species caught today. Nonetheless, the official data is not sufficiently complete and rigorous to confirm or reject this conclusion. Marine data to be collected by the BMAP will help clarify this. Fishermen advanced a series of possible explanations for their perceptions, including the release of toxic materials, as well as dredging and the resulting sand accumulation. The Panel was not been able to independently validate these explanations.

A compensation program for registered fishermen was put in place by Peru LNG in 2007. A differentiated scale of payments was applied, depending on distance from the Peru LNG loading port at Melchorita. Despite these payments, there is still some discontent and resentment among some fishermen over how this compensation was provided.

A noteworthy positive case involves the Artisanal Fishermen's Union of Tambo de Mora, which has channeled the resources received to support the union's production, commercial, and service initiatives, building a hall with an auditorium, conference rooms, training areas, areas for marketing resources to generate income for the union, and capacity-building.

Indigenous Communities in Camisea

With regard to indigenous issues, based on an initial field visit to Camisea in 2012, a number of major areas of local concern were identified as the focus of the Panel's research: a universally noted decline in fish and game stocks; dissatisfaction with the education system; health status and health services; and the effectiveness and sustainability of social investments.

Fisheries

Fishing is a fundamental aspect of the diet, lifestyle, and food security of Amazonian populations, both indigenous and mestizo. The Panel summarized the results of a 2005 study, unpublished until recently, as well as a follow-up field study on the same region and some of the same communities in 2012, applying the same methodologies used in 2003-2005 in order to arrive at a longitudinal evaluation of changes in local fisheries over the past ten years.

Interviewees in Camisea independently mentioned a precipitous decline in the size and health of fish populations. Community members gave various explanations for this decline, varying from contamination by spills, vastly increased river traffic, or rising population.

The 2003-2005 study was carried out in three native communities in the Lower Urubamba, one native community in the Upper Urubamba, plus additional observations of commercial fishing and markets in the mission town of Sepahua. One location is a community in the Lower Camisea, in the area of direct impacts of the PlusPetrol gas project, composed mostly of Matsigenka indigenous inhabitants, and comprising 60 families with a population of 283 during the study period. The study in the four native communities consisted of ongoing participatory registry of fish catch, direct observation of fishing activities, and a standardized interview schedule with inhabitants of each of the study communities covering fishing technology, habits, preferences, commercialization, and perceptions of change in the fishery over recent years.

In 2003-2005, four species (*boquechico*, plus the catfish species *zúngaro*, *doncella*, and *cahuara*) represented about half of the total catch: 47 percent of the total catch by weight and 53 percent of the catch by frequency. The 2014 results showed a marked difference, with a diminishing catch but also a strengthened engagement in fishing for commercial purposes, as opposed to direct human consumption. The Panel considers that increasing demand for commercial fish catch in urban centers like Sepahua is a major factor for this switch.

There are several possible factors that may be behind the universally noted declines in the size and variety of fish for human consumption in the Lower Urubamba region:

- Increasing regional population, including both endemic population growth as well as the greatly increased arrival of new migrants;
- The widespread use of gill nets, which has increased greatly since the prior study in 2003 as a result of increasing access to cash and markets;
- Greatly increased river traffic in the form of large boats as a result of the Camisea gas project;
- Infrastructure projects that cause deforestation and erosion, especially in the Upper Urubamba;
- Extreme weather events, such as torrential rains, which have provoked mudslides, especially at higher elevations;
- The use of fish poison ("barbasco") and, in some instances (especially in the Upper Urubamba), the practice of fishing with explosives.

More generally, the Panel noted a lack of any serious oversight, organization, or study of fisheries in the region with a view to long-term management. Indeed, there is currently no plan in place to manage or increase fish production in the Lower Urubamba. Aquaculture projects, while meeting with a certain degree of success elsewhere in the Amazon, have so far been poorly implemented in the Lower Urubamba region. Several community projects have been installed by various institutions, but none appear to have proven sustainable or even minimally productive.

Flexible aquaculture pilot projects, adapted to the needs and preferences of local communities and preferably using local fish species, are badly needed as part of a broader fishery management and fish production strategy to meet the communities' subsistence needs.

Bilingual Indigenous Education

The Panel also studied the current school system for indigenous communities of the Upper and Lower Urubamba; discussed the historical, territorial, and cultural context of indigenous education in this region and throughout Peru; performed field observations and interviews with teachers during a visit to ten communities in the Lower Urubamba; and analyzed the results of a two-day-long participatory diagnostic workshop on education conducted with community leaders and educational administrators from the region. The main findings of the analysis were as follows:

- The educational system suffers from an internal lack of definition as to the nature and goals of bilingual intercultural indigenous education;

- Compounding this basic lack of definition, poor communication and deep-seated differences in approaches are noted between the two different organizations—the UGEL (attached to the Ministry of Education) and the RESSOP (attached to the Catholic Church)—that administer education in the region;
- Both non-indigenous and indigenous school teachers who work at local schools are not sufficiently informed on existing norms, guidelines, and materials regarding bilingual indigenous education, as promoted by the Peruvian Ministry of Education;
- The administrative system that handles education is not well-adapted to the cultural and geographical conditions in the region; and
- Poor communication between available health and education services represents a missed opportunity for synergies that could improve social development.

Health

The health status of the Matsigenka depends upon tightly interwoven cultural, environmental, epidemiological, economic, and historical factors. Their dependence on scattered forest resources provides a centrifugal force that is opposed by the centripetal forces of agriculture, social life, and more recently, education, healthcare, and economic opportunities available in permanent communities. Each family and community strikes a unique balance, affecting health, nutrition, and livelihood in complex ways.

The study, based on standard World Health Organization Protocols similar to those used in the prior studies by Toonen et al. (1996) and Llanos et al. (2009), involved height and weight measurements of women and their children under 5 years of age, voluntary laboratory tests for anemia and intestinal parasites, and standardized interviews concerning maternal and child health indicators. Though these diverse studies used somewhat variable methods, sample sizes, and research focuses, they all concentrated on the same region and many of the same specific communities, including the community of Camisea itself, which the current study's health consultants also visited. Thus, it becomes possible to identify data on common aspects of health and arrive at a snapshot of the evolution of basic health indicators over recent decades in the region.

The Panel's study, conducted in 2014, is not statistically comparable to prior data because of the smaller sample size and reduced number of communities. Some patterns, however, clearly emerge: chronic malnutrition among children remains high, with 59 percent of children suffering from some form of malnutrition—41.2 percent exhibit chronic malnutrition, 11.7 percent acute malnutrition, and 8.8 percent general malnutrition, as defined by World Health Organization standards applied to height/weight/age measurements.

Table 6: Evolution of Child (under 5 yrs.) Nutritional Status, 1996-2014
Sources: Toonen et al. (1996); Llanos et al. (2008); Cabada et al. (2014)

Nutritional Indicator	1996 (n=81; 12 communities)	2008 (n=438; 11 communities)	2014 (n=34; 2 communities)
Chronic malnutrition (height/age)	30.9%	51.8%	41.2%
General malnutrition (weight/age)	18.5%	17.9%	11.7%
Acute malnutrition (weight/height)	2.5%	2.6%	8.8%

While child nutrition has tended towards a decline over the past twenty years, or at the very best, remained stagnant, adults paradoxically appear to already suffer from the negative impacts of over-nutrition brought on by the consumption of sugar and other processed foods. Elevated body mass index (an indicator of a tendency towards obesity) was found among just 1.5% of adults (both sexes) in 1996 (Tooney et al. 1996). In our 2014 study, fully 44.8% of the participating women had an elevated body mass index, and 10.3% were considered morbidly obese, predisposing them to diabetes, heart disease, and many other chronic illnesses.

Table 7: Selected Results of Illness Reports for Children under 5, 1996 and 2014
Source: Toonen et al. (1996); Cabada et al. (2014)

Condition	1996 (n=175)	2014 (n=34)
Overall disease prevalence	41.1%	70.5%
Respiratory	9.1%	58.3%
Diarrhea	20.0%	35.7%
Fever	6.3%	38.2%

In the Panel's 2014 study, of the 21 children under 5 whose vaccine cards were available—and despite high coverage (90-100%) for important vaccines such as BCG, polio, and yellow fever—some worrisome gaps exist, including a low rate of coverage for measles (31.6%), a very low rate of initial vaccination at birth for polio (though repeated doses as of two months achieve 100% coverage), and some inconsistency in the recommended follow-up doses of DPT and hepatitis B.

Water and Sanitation

Community water and sanitation projects were found to be grossly inadequate. At best, current water systems pipe untreated stream water with moderate to high degrees of fecal coliform contamination straight to household taps. Though more convenient than the community wells installed by missionary groups in the 1970s, this water, by contrast, is not safe for human consumption and very likely contributes to the high parasite loads observed in our field study. One community visited was constructing cell phone towers, even though it did not yet have clean drinking water in its taps, thus illustrating the observation that development priorities have gone seriously awry.

The sorry and declining state of indigenous health and community sanitation structures in the Lower Urubamba is simply not acceptable, given the wealth that Camisea has generated in all sectors of the Peruvian economy, and the hundreds of millions of dollars that have entered local and regional government coffers over the past ten years through the Canon royalty agreement.

The problem is no longer a matter of money, or even technology or expertise, but mostly of adequate planning and oversight. The main culprit is clearly the Peruvian Government, which has shown little capacity to invest the vast sums of money it has received in an adequate manner so as to improve the lives of the indigenous communities suffering the brunt of the adverse effects the Camisea gas project is unleashing. Companies are also partly to blame for lack of adequate foresight and balance in their own investments. Shell provided a detailed document about lessons learned after its own contract negotiations for the gas contract failed. Unfortunately, the new consortium doesn't appear to have learned these lessons. Finally, the indigenous federations themselves are also partly to blame. During field visits, local people complained bitterly about the corruption and lack of capacity, planning, and vision affecting the indigenous federations and local community leadership.

Conclusions

Large amounts of money have been invested without adequate strategic planning or oversight, yielding modest results, if any. Without independent and transparent monitoring procedures, and with apparently no adequate baseline community resource studies, there is little hope of understanding the ultimate causes and responsibilities. As mentioned in the section on regional and local development, the Municipality of Echarate is currently one of the wealthiest in Peru in terms of total income due to huge Canon royalty investments, yet this wealth has not filtered through to the local inhabitants.

The regional government, municipality, gas and oil companies, indigenous federations, and communities themselves seem to have no long-term plans or priorities for sustainable social development, and projects seem to be executed in terms of the logic of maximum visibility rather than any strategic plan for social and economic development.

It is hoped that the Panel's work will lead to a profound rethinking of investment priorities and the development of adequate strategies to bring about culturally and environmentally appropriate health, sanitation, and development in those communities whose lands are yielding up so much wealth to outsiders, with so little benefit for themselves.

Conclusions

The building blocks summarized above allow the South-Central Peru Panel to draw a broader "picture," which is now emerging with regard to Camisea.

The most important conclusion is that Camisea has produced measurable and very substantial macroeconomic benefits, including major contributions to competitiveness through the supply of cheap energy, with the resulting major contributions to economic growth and poverty reduction in Peru.

The environmental aspects are also positive. The project has helped reduce greenhouse gases from energy and land sources. The model of "inland-offshore" hydrocarbon development has resulted in negligible deforestation in fragile Amazonian ecosystems; new marine habitats have been created at the export facilities; and capacity-building opportunities have been seized through the BMAP.

At the same time, the Panel has uncovered various weaknesses in the underlying institutional environment in which Camisea operates. These occur primarily at the regional and local levels, where local governments have a very poor capacity for the execution of development projects. The enormous economic benefits of Camisea to the country as a whole have not translated into local development benefits. In the case of indigenous peoples, the Panel has shown that they have not benefited from the project and, in certain aspects, they may be worse off than before.

This overall picture, however, is overwhelmingly positive. Camisea is a project that has been executed following the strictest environmental and social standards, and has introduced numerous instances of best practices, with long-term capacity building elements. In addition, Camisea can serve to "raise the bar" regarding environmental and social standards that should become the norm in the future.

From a longer-term historical perspective, and in the context of the "boom and bust" cycles that have characterized the history of natural resource use in Peru, history has fortunately not repeated itself, although Camisea is very much still in the "boom" stage. Unlike the previous cases of guano, saltpeter (nitrates), and rubber, Peru has so far been able to develop Camisea well and the benefits have accrued to most segments of society.

Looking forward, gas has become crucial for economic growth and competitiveness, but, depending on the assumptions, will run out in about a decade unless more is found. This

creates a "snowball effect" in which the weaknesses identified will multiply unless they are effectively addressed in future projects.

Clearly, it is not just future projects that must introduce best practices and the positive lessons learned from Camisea. Equally important is the strengthening of the institutional fabric, especially at the local levels.

Annex I: The Independent Advisory Panel on Development Issues in Southern Peru

The Independent Advisory Panel on Development Issues in South-Central Peru (The Panel) was formally established at the end of 2009 in the context of the Peru LNG Project. The Panel was formed to advise the Export-Import Bank of the United States (Ex-Im Bank) and other interested parties on the environmental and social effects of development in South-Central Peru. The Panel is based in Lima.

Ex-Im Bank made the creation of the Panel a condition for the Bank's approval of financial support for the Peru LNG Project. In early 2008, the Bank approved a $458.6 million long-term loan guarantee to support U.S. exports for this project, which became operational in mid-2010. The recent development of South-Central Peru is driven largely by new energy projects, including Peru LNG.

The Panel was selected by Ex-Im Bank in 2009. The Panel members serve on a pro bono basis. The Panel acts independently of the Ex-Im Bank or any other public or private institution or government. In view of its independence, the Panel has the ability to define the scope of its work, including both its thematic and geographic areas of study. In such regard, the first decision of the Panel was to extend the scope of its deliberations beyond the Peru LNG project alone, including the larger south-central region of Peru.

Annex II: Background Papers and Past Reports

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Notes:

1. These documents can be downloaded from: http://www.southperupanel.org/html-us/descargas.php
2. Additional bibliography and sources consulted are indicated in each Annual Report.