The Role of Institutions in Access and Allocation of Emission Trade System in Central America*

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Highlights

A multi-criteria analysis is adopted to assess the effects from ETS's architecture in Costa Rica, El Salvador, Guatemala, Honduras and Panama.

The architecture of institutions in Central America has limited the environmental and social benefits obtained from ETS in the region.

To improve the benefits from ETS in Central America, the assumed commitments by country trough Kyoto Protocol are in the national laws.

Abstract

The benefits obtained from ETS have been traditionally studied with an economic scope and referred to as an instrument that facilitates the exchange of CER's with the lowest transaction costs within market mechanism. Nevertheless, the ETS is more than a market, it is an institution and the set of rules, procedures, and guidelines which it dictates are the most important factors to ensure successful implementation. This paper presents an assessment of the effects of the ETS in Central America, considering that the participation of the region in this mechanism is affected by the institutional adjustments that could not be legally adopted, due to the instrument's design which does not allow it to be adapted to local conditions. A multi-criteria evaluation method is applied to weigh the institutional, economic, environmental and social impacts observed in 17 CDM projects in Costa Rica, El Salvador, Guatemala, Honduras and Panama. The results achieved by the multicriteria evaluation hold

* The opinions expressed by the author in this paper do not necessarily reflect the official position of her institution.

that the economic, social and environmental impacts have been influenced by the institutional architecture adopted in the region but they can be modified if the assumed rules, guidelines and procedures by country in the ETS as a Kyoto Protocol mechanism are adopted in the national laws.

Key Words

Allocation, Access, Clean Development Mechanism, Emission Trade System (ETS), Institutions, Sustainable Development.

1. Introduction

The Emission Trade System (ETS) is an economic mechanism derived from international climate change policy which the aims to reduce greenhouse emissions, and its enforcement involves a series of institutional and economic adjustments that have not been fully covered by the host countries, mainly, parties not included in annex I. In addition to that, the ETS in parties not included in annex I, are not being implemented within global climate governance systems, making it impossible to maximize the benefits obtained from the Certified Emissions Reduction (CER's) exchange.

From an economic point of view, the ETS is an efficient mechanism for reducing greenhouse emissions with the lowest transaction costs; nevertheless, the economic and institutional realities of the host countries not included in annex I, are the most important factors for its operation. The success or failure of the ETS will depend on the normative framework and implementation procedures.

At the end of the first Kyoto Protocol period, Costa Rica, El Salvador, Guatemala, Honduras, and Panama had registered 103 projects as CDM projects which totaled 8,008, 449 tCO2e CER’s per year, most of these projects were hydroelectric power plants (50) which totaled 2,946,905 tCO2e CER’s per year (UNCCCF, 2017). The hydroelectric projects that were executed in the region during 2008 -2012 were characterized by environmental, social, and economic impacts, in some cases they had a significant impact on the environment.

The benefits obtained by the CER's exchange in Central America were not equated to the allowances obtained in parties included in annex I; however, Central America continues to participate in the ETS scheme as host countries. One of the reasons to explain unequal terms of the exchange is the rigidity of the ETS to be implemented and the absence of a strong institutional network in host countries.

This paper analyses the process in which the ETS was enforced in five countries in Central America. To achieve this aim, this approach uses a neo-institutional analysis to identify the predominant legal framework for the ETS in Central America and Multicriteria Analysis (MCA) to assess the economic, social and environmental impacts, the AMC applied was adapted to article 12 of Kyoto Protocol. First step: An analytical set of multiple criteria regarding both the economic and environmental of each project selected. Second step: Each of these criteria is weighted. Third step: Each project is evaluated against the weighted criteria. Fourth step: Different grades are summed up, providing a single value which synthesizes its overall performance.

2. The ETS in Central America

The incorporation of the CDM and JI into the EU ETS allows that sustainable projects in non-Annex I countries could participate in the international exchange of CERs. By the end of the first Kyoto period, l 2,943 projects were registered under the CDM had already issued 1,481, 732,967. 21 of CER 's. (UNFCC, 2012a)

At the end of the first Kyoto period, Central American countries recorded 103 CDM projects which totaled eight million tons of CO_2e reduced; in this record, 49 projects were Hydroelectric Power Plants (HPP); of total, 17 plants were large scale and totaled 2,240, 937 tCO2e in CER 's. (UNFCCC, 2015d). The originating host countries were: Costa Rica, El Salvador, Guatemala, Honduras and Panama. The hydroelectric power plants have the greatest participation in the generation of energy at the regional level; there are also projects with the highest number of CER' s registered and are the projects with the greatest economic, social, and environmental effects.

The benefits obtained from the ETS in Central American countries are lower than those in the countries which buy the CER´s. The promotion of sustainable development and security of energy supply are the most important benefits in parties not annex I; however, they are not completely achieved, because the national laws and the States participation are not according to this environmental policy (Zajac A. 2016). On the other hand, the ETS is not creating the right incentives to reduce emissions in the short and long term because the economic efficiency of this instrument depends on the ability of the EU and other countries to establish rules that modify in the short, medium and long term, the behavior of agents and investment decisions. (De Perthuis C. y Trotignon R., 2014). As Zajac held, Rabe B. concluded that the ETS had serious limitations such as: Identifying the most effective strategy according to the political and the institutional realities in the participating countries, or the absence of consistency in other areas of public policy (Rabe B. 2010).

The ETS' operation produced benefits and negative impacts; the latter, have been recorded mainly in the Developing Countries. But also, the negative impacts were not considered in the functioning of the mechanism because the ETS was created according to economic efficiency; nevertheless, the structural rigidity on the supply side (Clo. S.; Battles S.; Zoppoli P.; 2013) and the institutional weaknesses, have been translated into the negative results.

3. Large-Scale Hydroelectric Projects in Central America

As mentioned in the previous section, the Central American region registered 49 hydroelectric plants and seventeen of them was a large-scale project. The host countries were Costa Rica, El Salvador, Guatemala, Honduras and Panama; Nicaragua and Belize did not record a large-scale hydroelectric project during the period 2008-2012. Table 1 summarizes the general characteristics of the 17 hydroelectric plants registered in the CDM by Central America

Table 1: Large-scale hydroelectric plants in Central America (2012)

Country	Installed Capacity (MW)	Projects Number	Credit Period (Years)	Certified Emissions Reductions tCO2e	Environmental Impacts	Executing Agency
Belize	-	-	-	-	-	-
Costa Rica	190.0	4	7	273,402	Not perceptible to strong	Private
El Salvador	65.4	1	7	144,091	Strong	Public
Guatemala	299.6	5	7	808,818	Not perceptible to strong	Private
Honduras	37.9	1	7	109,168	Low	Private
Nicaragua	-	-	-	-	-	-
Panama	366.9	6	7	927,365	Not perceptible to strong	Private
Total	**959.8**	**17**		**2,262,844**		

Source: Own preparation based on https://cdm.unfccc.int/Projects/index.html

Table 1 excluded the small-scale project to concentrate the analysis on the larger impacts. It is important to note that the executing agency for the projects, generally corresponded to private companies except for El Salvador, where the executing agency was the government.

Costa Rica registered four large-scale projects: "La Joya", "Chúcas", "El General" and "Torito". The four projects totaled 200 MW of installed capacity. They expected to reduce 273,401 tCO2e per year. It is important to mention that the beginning of the credit period was not in the same year; for example: "La Joya" began the crediting period in 2006 (UNFCCC,2014); "El General" in 2011 (UNFCCC, 2013), "Chúcas" in 2014 (UNFCCC, 2012b) and "Torito" in 2015 (UNFCCC, 2012a). The electricity market in Costa Rica is private, therefore, the investment and permits were granted by "*Instituto Costarricense de Electricidad"* under the Built Operation Transfer (BOT) Scheme. The Environmental Impact Studies estimated that implementation of two ("La Joya" and "El General") of the four projects, would not cause significant damage to the environment. "Chucas" and" Torito

"caused flooding and reduced water flow. On the other hand, the generation of employment and investment related to the four plants had a significant impact on the surrounding populations; the four projects invested $ 422.7 million in the construction phase and generated 1,800 temporary jobs.

El Salvador, the smallest country in the region, recorded “El Chaparral” hydroelectric project with an installed capacity over 65 MW. "El Chaparral" is the only Central America project executed by a state entity, the "*Comisión Ejecutiva Hidroeléctrica del Río Lempa*" (CEL). The project was financed by the Central American Bank for Economic Integration (CABEI) with $ 207.9 million dollars and generated 500 temporary jobs. The Environmental Impact Study estimated that the project would reduce 144,000 tCO2e per year as of 2011; also, considered that the project was not exempt from damaging the ecosystem, the main impacts were the loss of vegetation cover, destruction of the road network, interruption of the transit of aquatic fauna. As a remedial measure, the project estimated a reforestation program, a fish farm and the construction of a new road network. (UNFCCC, 2006f)

The electricity market in Guatemala, as in Costa Rica and El Salvador, is a private market. Guatemala recorded five hydroelectric power plants with an installed capacity over 300 MW. "El Canada", "Las Vacas", "Palo Viejo", "Santa Rita" and "Xacbal" were built and operated by a private agent. The absence of an expansion plan for the electricity sector and inadequate incentives in the legal framework were the main factors for delays in the start-up of projects and that the projects indeed respond to economic interests. It was until the amendment of the Power Purchase Agreement that the project contemplated the achievement of sustainable development. The Environmental Studies considered for the projects "Canada" (UNFCCC, 2015a) and "Las Vacas" (UNFCCC, 2005) would not cause significant impacts on ecosystems, while "Palo Viejo" (UNFCCC, 2006a), "Santa Rita" (UNFCCC, 2006h) and "Xacbal" (UNFCCC, 2006i) would cause landslides, erosion, and sedimentation of soils and the reduction of the volume of water. As remediation measures considered reforestation programs, community environmental management plan and improvement in the road network. The crediting periods included an initial seven-year period; a period in which the projects, will achieve annual reductions of over 808,818 tCO2e. The five projects were

related to an initial investment of $ 694 million dollars during construction phase the projects would generate 1,500 temporary jobs.

Honduras, as El Salvador, recorded only one project "La Vegona" power plant with an installed capacity over 37 MW. The absence of a private market created delays in project execution times because there were no clear rules or specific laws for renewable energy projects. The Environmental Study estimated that the power plant "La Vegona" would reduce 109, 168 tCO2e per year; also, it estimated that the project would not cause significant damage to the environment. On the other hand, the sensitivity study estimated an initial investment with $ 98 million dollars and the job creation of 500 temporary jobs. The operation permit was granted according to a political decision. (UNFCCC, 2006g)

Panama recorded six projects: "Baitún" (UNFCCC, 2015b), "Bajo de Mina"(UNFCCC,2015c), "Bajo Frío" (UNFCCC, 2006b), "Barro Blanco" (UNFCCC, 2006c), "Dos Mares" (UNFCCC, 2006d) and "Mendre"(UNFCCC, 2006d). The six projects totaled an installed capacity of 348.3 MW. The financial study revealed for six investment projects an initial investment of $ 1,048.4 million. During the construction phase, six projects would generate 5, 200 temporary jobs The Environmental Study calculated that the average annual reductions would be 1 268,417 tCO2e. All the project would generate damage to the ecosystem.

Multi-criteria analysis

To assess the performance and impacts of hydropower plants, it was necessary to commensurate the data obtained in the Project Design Document (PDD). The first step was to express the total annual reductions per project as a percentage of the baseline emissions estimated in the PDD. Table 1 presents the result of this operation.

Table 1: Annual Reductions as a percentage of the Baseline

Project	Baseline Emissions tCO_2e	Total Emissions Reductions *	Annual Emissions Reductions	Annual Reductions as a percentage of Baseline
	(1)	(2)	(3)	(4)
"La Joya"	592,732	421,261	60,180	10.20%
"Chúcas"	347,173	496,972	70,996	20.40%
"El General"	642,873	462,006	66,001	10.30%
"Torito"	506,660	533,575	76,225	15.00%
"El Chaparral"	1,868,148	1,008,637	144,091	7.70%
"El Canadá"	688,650	675,241	96,463	14.00%
"Las Vacas"	3,133,810	632,541	90,363	2.90%
"Palo Viejo"	1,808,961	1,808,961	258,423	14.30%
"Santa Rita"	364,917	364,917	52,131	14.30%
"Xacbal"	2,180,066	2,180,066	311,438	14.30%
"La Vegona"	764,176	764,176	109,168	14.30%
"Baitún"	1,831,060	1,831,060	183,106	10.00%
"Bajo de Mina"	1,194,800	1,194,800	119,480	10.00%
"Bajo Frío"	1,060,920	1,060,920	151,560	14.30%
"Barro Blanco"	468, 513	468,513	66,934	14.30%
"Dos Mares"	2,446,108	2,446,108	349,444	14.30%
"Mendre"	397,887	397,887	56,841	14.30%
Total	**19,828,941**	**16,747,641**	**2,262,844**	

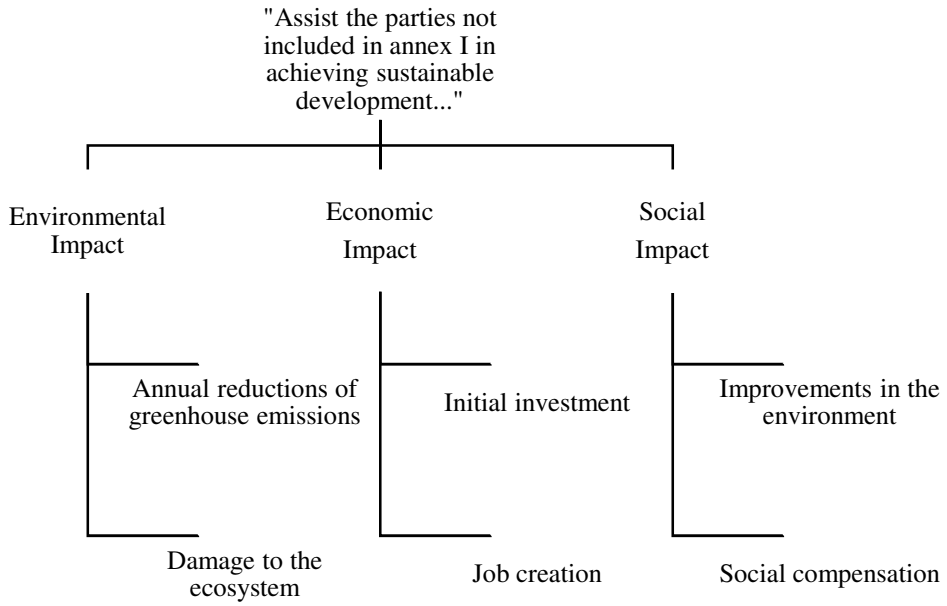
*Seven-year period

Source: Own preparation based on PDD

According to the Kyoto Protocol (article 12) parties not included in annex I can participate in the Clean Development Mechanism (CDM) with the purpose of achieving the sustainable development and assisting to Parties annex I in achieving their quantified emission limitations and reductions commitments. (CMMUCC, 1998)

The HPP produce 50% of the energy in the region (ECLAC, 2013); also, these are the projects with the major economic, social, and environmental impacts. To assess these impacts, a Multi-Criteria Analysis (MCA) is applied to compare the impacts and evaluate the general performance. The criteria tree is structured on three levels. The first level concerns to the objective 12 that the Kyoto Protocol should achieve, in this case, it is related to achieving the sustainable development. The second level considers three main criteria: environmental impact, economic impact, and social impact; each of them is composed of a set of sub-criteria (Third level). All the information was provided by the Project Design Document (PDD). Figure 1 shows the multi-criteria tree.

Figure 1



Source: Prepared by the author based on the PDD

1. Environmental impact: modification of the environment caused by the action of man and nature, eventually caused by the works or activities that are in the project (potential impacts), or have not been initiated. (SEMARNAT, 2013);

   1.1 Annual Reductions of Greenhouse Emissions: measured as a percentage of emissions reduction in relation to the emissions estimated by the baseline of the project.

   1.2 Damage to the Ecosystem: Negative alterations to the immediate ecosystem generated by the project.

2. Economic impact: Economic multiplier produced by the hydroelectric power plants for the country and the immediate environment.

2.1 Initial investment: To be recorded in the U. S. dollars. It corresponds to the necessary disbursement for the construction phase of the project.

2.2 Job creation: Estimated by the number of direct jobs that are generated during the construction phase of hydroelectric power plants.

3. Social impact: Everything that is linked to a project, and which affects any group of actors (IAIA, 2015: 2)

3.1 Improvements in the environment: The quality of the air and water used by the population, the availability and quality of the food they eat, the level of danger or risk, dust and noise to which they are exposed, adequacy of sanitation, and their access to and control over resources (IAIA, 2015:2)

3.2 Social compensation: the type of social compensation that the project grants to the nearby population

Based on the criteria tree detailed in Figure 1, the analysis matrix of the criteria and sub-criteria of the projects was established. Table 2 shows the characteristics for the projects described in the previous section.

Table 3: Input Variables

	Environmental Impact		Economic Impact		Social Impact	
	Annual Reduction as a percentage of Baseline	**Damage to the Ecosystem**	**Initial Investment**	**Job Creation**	**Improvements in the Environment**	**Social Compensation**
"La Joya"	10.20%	No	$130.00	500	"Parchimal" pipeline	Unspecified
"Chúcas"	20.40%	Flooding	$113.30	200	The destruction of a bridge	New bridge
"El General"	10.30%	No	$70.40	500	Unspecified	"Social and Ecological Fund"
"Torito"	15.00%	Reduced water flow	$138.90	600	Path network	Restitution of water flow
"El Chaparral"	7.70%	Loss of aquatic species	$207.90	500	Bridges, path network	Financial compensation for 27 families
"El Canadá"	14.00%	No	$66.90	250	Reforestation Plan	Unspecified
"Las Vacas"	2.90%	No	$36.60	700	Unspecified	Environmental Programs
"Palo Viejo"	14.30%	Landslide, soil erosion	$240.20	1000	Environmental Management and Community	Cooperation Agreement with municipality
"Santa Rita"	14.30%	Degraded soil quality	$66.80	Algunos	Reforestation Plan and wood saving stoves	Financial Fund
"Xacbal"	14.30%	Reduction of water flow	$250.00	400	Path network	Annual financial Fund $30,000
"La Vegona"	14.30%	No	$98.00	500	Improvement on the road network	Construction of health center for the community
"Baitún"	10.00%	Deforestation and soil sedimentation	$219.10	Algunos	Improvement on the road network	20% CER's sales revenue to the community
"Bajo de Mina"	10.00%	Deforestation, soil erosion and soil sedimentation	$138.90	Algunos	Improvement on the road network	20% CER's sales revenue to the community
"Bajo Frío"	14.30%	Change in natural water flow, reduction of aquatic fauna	$190.30	Algunos	Improvement on the road network	20% CER's sales revenue to the community
"Barro Blanco"	14.30%	Loss of plant cover and tree species	$92.90	Algunos	Improvement on the road network	Environmental Education Program
"Dos Mares"	14.30%	Loss of agricultural soil	$366.60	3000	Improvement on the road network	Unspecified
"Mendre"	14.30%	Soil erosion and sedimentation, loss of agricultural land	$40.60	200	Basic services infraestructure	Cooperation Agreement with municipality

Source: Prepared by the author based on PDD

As shown in table 2, the projects required different levels of investment, work, installed capacity, improvements in the environment, and social compensation; however, without considering these differences, in most of the cases, the projects had a significant impact on the environment.

4. Ranking Techniques

Two alternative methods have been adopted to evaluate the criteria and sub-criteria presented in Table 2. The first method consists in valuing the sub-criteria, it limits the assessment from the most beneficial effect to the least beneficial effect. In some cases, the least beneficial effect records the value of (0) and the most beneficial effect records the value of (1); while in others, the least beneficial effect will be (-1) and the most (1). These cases implied negative impacts or increasing costs, for example, damages to the ecosystem and impact on the social environment. On the other hand, a sub-criteria is valuing with (0.5) when it does not generate any change in the environment or only establishes some impacts without specifying them. The normalization from 0 to 1 includes the sub-criteria: Annual reduction of emissions, initial investment, job creation and social compensation. Table 3 shows the scale of grades to assess the project´s performance.

The first evaluation method does not admit a distinction between the impacts; therefore, a second method is applied to ponder the values estimated in the first method. The results will reflect the preferences of the policy makers for criteria and sub-criteria. The second method uses a profit maximization to assign a value of 33 per cent to each criteria. The assigned value was equal to the three criteria because the main purpose of sustainable development is to achieve equality in economic, social and environmental conditions. Table 3 shows the grades to value the general performance and impact of each project.

Table 4: Scale of grades to assess the project´s performance

Criteria/Sub-criteria	Grade with method 1	Grade with method 2
Environmental Impact		**0.330**
Annual Reductions of Greenhouse Emissions	+	0.165
Damage to the ecosystem	-	0.165
Economic Impact		**0.330**
Initial Investment	+	0.165
Job Creation	+	0.165
Social Impact		**0.330**
Improvements in the environment	-	0.165
Social Compensation	+	0.165

Source: Own preparation

5. Grading project's performance

The results presented in Table 5 were ordered considering the projects with the highest value in each criteria. As shown in Table 5, and contrary to expectations, "La Vegona" in Honduras, was the project with the highest score. Even though, the installed capacity of the plant and the initial investment was not significantly high. The highest score for "La Vegona" is related to environmental and social impact; the first one, because of the project not producing damage on the environment, and the second one, was due to improvements in the road network.

The worst rating was for the "Chúcas" power plant in Costa Rica. Even if, it had a significant initial investment, installed capacity of 50 MW and the highest annual emission reductions; the damage to the ecosystem and the absence of social compensations, influenced on the project ranking.

5.1 Grading the environmental performance

A general assessment of the projects indicates that as the plants increase their installed capacity, the environment is more sensitive to the environmental damages caused and less likely to be remedied. The low score on hydroelectric plants is related to the inevitable generation of environmental damage, added to the fact that a project developer does not consider remediation measures or social compensation.

On the other hand, the political and institutional conditions in some cases in the region were not favorable to project operations. The legal framework was inadequate for the promotion

of renewable energy projects; however, in some cases as Honduras, where the granted operating license was based on a political decision, it had a positive result.

Annual Greenhouse Reductions as a percentage of baseline was not significant; also, it was not proportional to the installed capacity of the project. The CER's obtained by CDM were opposite to expectations in long term targets. Damage to the ecosystem was a sub-criteria in which the major parts of projects reflected a negative value which was unavoidable considering the size of the projects and the impacts on the environment as soil erosion, flooding, loss of aquatic species and so on.

Grading Economic Performance

The highest score in economic impact was for "Dos Mares" power plant in Panama. The project obtained the highest score due to a high level of investment and the creation of jobs. The worst score was for "Mendre" power plant in Panama, this result was related to the lowest investment and creation job.

The findings demonstrate that projects in general promoted the private investment and employment opportunities; it is important to note that, there is a direct relationship between the level of investment and job creation; according to the investment the number of jobs increases; also, the environmental impact.

Grading Social Performance

The projects in general recorded a positive social impact, with the exception in "El General", "Las Vacas" and "Chúcas", all of them in Costa Rica. This result indicated the inverse relationship between the improvements in the environment and social compensations, and the absence of commitment between the host party and the project developer to avoid the negative impacts. Table 4 shows the general performance of the hydroelectric power in Central America.

Table 5: General Performance of Hydroelectric Power Plants in Central America

Project	Annual Reduction as a percentage of Baseline	Damage to the Ecosystem	Environmental Impact	Initial Investment	Job Creation	Economic Impact	Improvements in the Environment	Social Compensation	Social Impact	Total	Ranking
"La Vegona"	0.65	1.00	**1.65**	0.19	0.11	**0.29**	1.00	1.00	**2.00**	**3.94**	1°
"La Joya"	0.42	1.00	**1.42**	0.28	0.11	**0.39**	1.00	0.00	**1.00**	**2.81**	2°
"El Canadá"	0.64	1.00	**1.64**	0.09	0.02	**0.11**	1.00	0.00	**1.00**	**2.74**	3°
"Dos Mares"	0.65	-1.00	**-0.35**	1.00	1.00	**2.00**	1.00	0.00	**1.00**	**2.65**	4°
"Bajo Frío"	0.65	-1.00	**-0.35**	0.47	0.50	**0.97**	1.00	1.00	**2.00**	**2.62**	5°
"Palo Viejo"	0.65	-1.00	**-0.35**	0.62	0.29	**0.91**	1.00	1.00	**2.00**	**2.56**	6°
"Baitún"	0.41	-1.00	**-0.59**	0.55	0.50	**1.05**	1.00	1.00	**2.00**	**2.46**	7°
"Xacbal"	0.65	-1.00	**-0.35**	0.65	0.07	**0.72**	1.00	1.00	**2.00**	**2.37**	8°
"Barro Blanco"	0.65	-1.00	**-0.35**	0.17	0.50	**0.67**	1.00	1.00	**2.00**	**2.32**	9°
"Bajo de Mina"	0.41	-1.00	**-0.59**	0.31	0.50	**0.81**	1.00	1.00	**2.00**	**2.22**	10°
"Torito"	0.69	-1.00	**-0.31**	0.31	0.14	**0.45**	1.00	1.00	**2.00**	**2.14**	11°
"El Chaparral"	0.27	-1.00	**-0.73**	0.52	0.11	**0.63**	1.00	1.00	**2.00**	**1.90**	12°
"Santa Rita"	0.65	-1.00	**-0.35**	0.09	0.00	**0.09**	1.00	1.00	**2.00**	**1.74**	13°
"Mendre"	0.65	-1.00	**-0.35**	0.01	0.00	**0.01**	1.00	1.00	**2.00**	**1.66**	14°
"El General"	0.42	1.00	**1.42**	0.10	0.11	**0.21**	-1.00	1.00	**0.00**	**1.63**	15°
"Las Vacas"	0.00	1.00	**1.00**	0.00	0.18	**0.18**	-1.00	1.00	**0.00**	**1.18**	16°
"Chúcas"	1.00	-1.00	**0.00**	0.23	0.00	**0.23**	-1.00	1.00	**0.00**	**0.23**	17°
Total			**2.47**			**9.72**			**25.00**		
			3°			2°			1°		

Source: Own preparation

6. Sensitivity analysis

According to the Method 1, "La Vegona" power plant is the first-best project. Nevertheless, the first method ranking does not allow us to determine an unequivocal order among the projects. To overcome this problem, the Method 2 will rank preferences for each project, as Table 3 showed. In this case, "La Vegona" power plant is the first-best option, while "Chúcas" power plant continues to be the worst option. However, in contrast to Method 1, a clear ranking in the impacts can be seen. The final ranking depends on the assigned grades and on the coefficients weights presented in Table 3. These reveal a high preference for social (4.13) and economic impact (1.60) compared with environmental impact (0.45). Table 5 shows the grades and ranking of the projects (method 2)

Table 6: General Performance of Hydroelectric Power Plants in Central America

Project	Annual Reduction as a percentage of Baseline	Damage to the Ecosystem	Environmental Impact	Initial Investment	Job Creation	Economic Impact	Improvements in the Environment	Social Compensation	Social Impact	Total	Ranking
"La Vegona"	0.11	0.17	**0.27**	0.03	0.02	**0.05**	0.17	0.17	**0.33**	**0.65**	1°
"La Joya"	0.07	0.17	**0.23**	0.05	0.02	**0.06**	0.17	0.00	**0.17**	**0.46**	2°
"El Canadá"	0.10	0.17	**0.27**	0.02	0.00	**0.02**	0.17	0.00	**0.17**	**0.45**	3°
"Dos Mares"	0.11	-0.17	**-0.06**	0.17	0.17	**0.33**	0.17	0.00	**0.17**	**0.44**	4°
"Bajo Frío"	0.11	-0.17	**-0.06**	0.08	0.08	**0.16**	0.17	0.17	**0.33**	**0.43**	5°
"Palo Viejo"	0.11	-0.17	**-0.06**	0.10	0.05	**0.15**	0.17	0.17	**0.33**	**0.42**	6°
"Baitún"	0.07	-0.17	**-0.10**	0.09	0.08	**0.17**	0.17	0.17	**0.33**	**0.41**	7°
"Xacbal"	0.11	-0.17	**-0.06**	0.11	0.01	**0.12**	0.17	0.17	**0.33**	**0.39**	8°
"Barro Blanco"	0.11	-0.17	**-0.06**	0.03	0.08	**0.11**	0.17	0.17	**0.33**	**0.38**	9°
"Bajo de Mina"	0.07	-0.17	**-0.10**	0.05	0.08	**0.13**	0.17	0.17	**0.33**	**0.37**	10°
"Torito"	0.11	-0.17	**-0.05**	0.05	0.02	**0.07**	0.17	0.17	**0.33**	**0.35**	11°
"El Chaparral"	0.05	-0.17	**-0.12**	0.09	0.02	**0.10**	0.17	0.17	**0.33**	**0.31**	12°
"Santa Rita"	0.11	-0.17	**-0.06**	0.02	0.00	**0.02**	0.17	0.17	**0.33**	**0.29**	13°
"Mendre"	0.11	-0.17	**-0.06**	0.00	0.00	**0.00**	0.17	0.17	**0.33**	**0.27**	14°
"El General"	0.07	0.17	**0.23**	0.02	0.02	**0.03**	-0.17	0.17	**0.00**	**0.27**	15°
"Las Vacas"	0.00	0.17	**0.17**	0.00	0.03	**0.03**	-0.17	0.17	**0.00**	**0.19**	16°
"Chúcas"	0.17	-0.17	**0.00**	0.04	0.00	**0.04**	-0.17	0.17	**0.00**	**0.04**	17°
Total			**0.41**			**1.60**			**4.13**		
			3°			2°			1°		

Source: Own preparation

7. Conclusions

The multi-criteria evaluation allowed to evaluate the performance and impact of hydroelectric power plants operating under the CDM, the results obtained holds that projects which include the improvements in the environment and social compensation have a better performance than the projects with a low level of investment or jobs.

In general, the projects promoted the private investment and employment opportunities; there is a direct relationship between the level of investment and job creation; according to the investment the number of jobs increases; also, the environmental impact. The projects generate more positive impacts at the social level than the economic and environmental level. At the environmental level, the projects did not lead to high profits, this result was affected by the low levels of emission reductions and the damages that projects generated.

Environmental effects are related to the requirements of the commitments that each project assumes in the PDD, the improvement in these effects would be a reform in the PDD. The operating permits granted would base on a plan or agreements which rule the environmental benefits.

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