<u>Carhuaquero IV – Project Review Responses to the CDM Executive Board</u>
February 26, 2008

1. (EB) Further substantiation is required regarding the investment barrier; in particular as the costs of the alternatives are generic rather than specific in the Peruvian context and also that the investment costs alone are not an adequate means of comparison between thermal and hydro plants.

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The application of a cost comparison among technologies was to demonstrate that the technology used for Carhuaquero IV is more expensive than thermal alternatives and is therefore more difficult to finance. We used generic costs in order to avoid particular examples that may not be representative for project costing.

The problems faced in making this project economically attractive are explained in the barrier analysis. Due to the very low load factor of the plant and its operation only during the rainy season, the project suffers several impacts which make it relatively uncompetitive. These impacts include:

1. Low project revenue relative to the scale of its infrastructure investment.

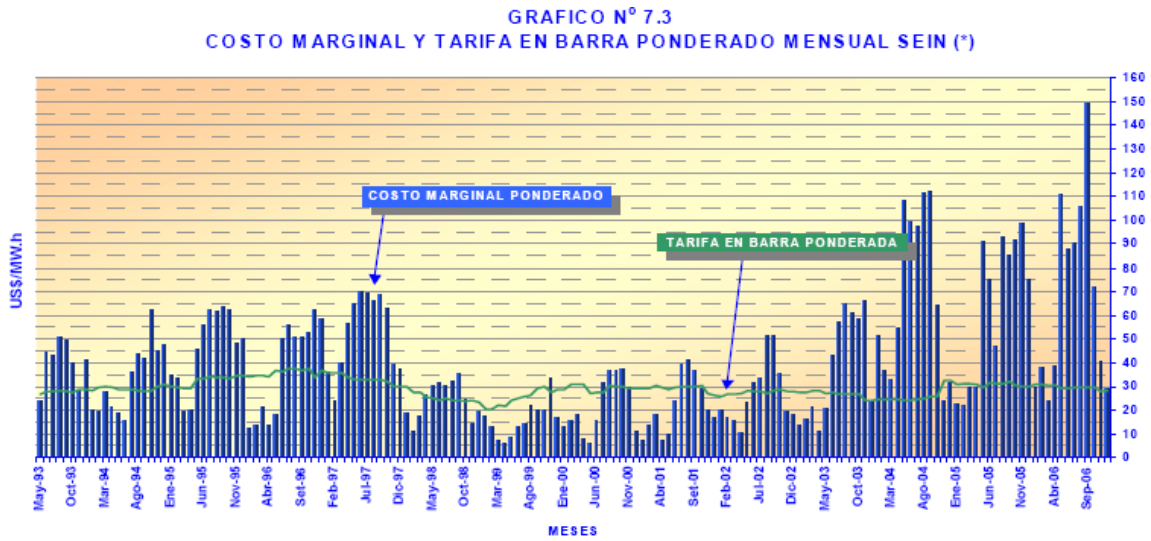
2. Since the project only operates in the rainy season, it will receive the lowest tariff available, as during this rainy season overall tariffs are lower due to full operation of all hydroelectric power plants in the grid system, which their marginal cost are zero. As was described in the PDD, the hydroelectric energy potential of the Project consists of taking advantage of excess water flows during the rainy seasons (2.5 m^3/s in average), after first satisfying the water flow requirements of the existing, larger Carhuaquero hydropower plant (with water flows of 24 m^3/s). Thus, in the dry seasons (May to November) the project produces almost no energy.

In the IRR spreadsheet calculation for this project (in workbook "2. Energy Production Estimation") the calculation of the expected energy production for Carhuaquero IV is shown, based in historical hydrology, demonstrating its low expected production during dry season.

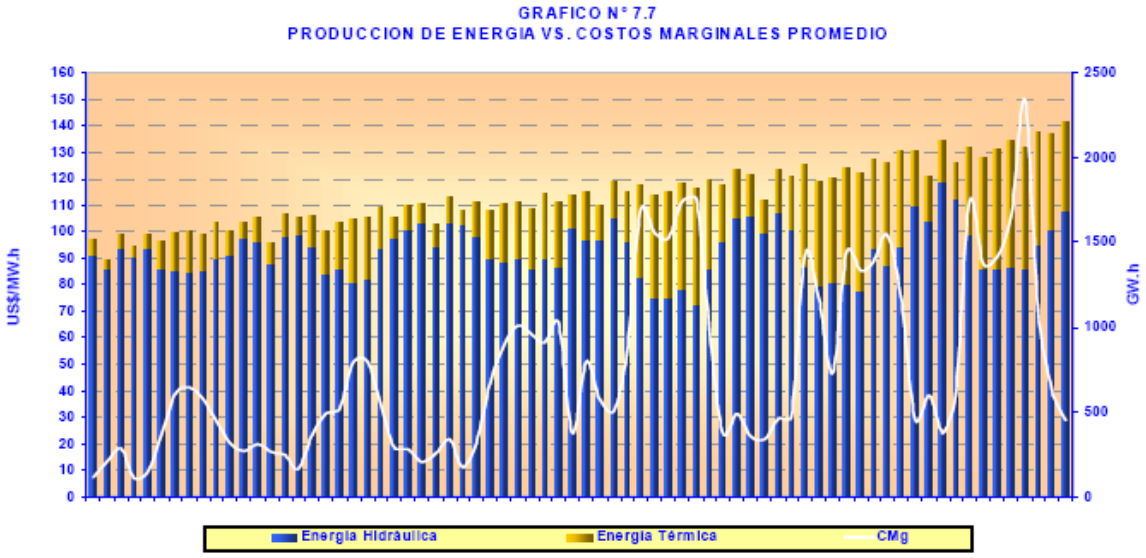
Since in Peru, the tariff is calculated based in the marginal cost of the plants dispatched in the national grid, tariffs increases during the dry season owing to increased operation of thermal plants which have higher marginal costs than those of hydros (the marginal cost of hydro facilities in Peru is considered zero).

The following figure (taken from the annual statistics 2006 of COES1) clearly shows how the marginal costs are considered to be lower during the rainy season.

[1] COES - Peruvian dispatch centre. Estadística de Operaciones 2006 page 56
http://www.coes.org.pe/DataWeb/2006/DTR/estadistica/ANUAL/anual.htm



In addition, the following figure 2 is taken from the same document, and clearly shows that when hydros are dispatching more, the marginal costs are low, and when they produce less, the marginal costs are high (the period described is Dec. 2000 – Dec. 2006).



No capacity payment for guaranteed power is available to the plant as it is not possible to guarantee a minimum operation during the dry season due to the project's dependence on water flows in excess of the full capacity of the existing hydroelectric power plant located upstream.

Regarding the availability of capacity payment: The government has established a payment for the capacity of a project to deliver energy during the most critical season of the year, which is the dry season. Hydrology studies for the project have established that there is not a high probability that the project will produce energy in dry months (such as August) due to the shortage of adequate water resources (and due to both its status as a run-of-river operation with no storage capability as

[2] COES - Estadística de Operaciones 2006, page 58
http://www.coes.org.pe/DataWeb/2006/DTR/estadistica/ANUAL/anual.htm

well as to being subordinated to the existing upstream project). Thus, the project does not qualify for payment solely for capacity (i.e. standby availability), and the sponsor cannot rely on this revenue.

However, this does not mean that the project is unable to produce energy; it simply means that during the dry months, it cannot provide a minimum amount of energy production during the dry months and thus does not qualify for the capacity payment. This is a categorical situation common to renewable energy generators, which, due to their limitations on storage and/or dispatch ability, often find that their use of an otherwise 'free' fuel source, nevertheless find themselves at a disadvantage compared to thermal generators who do not face these operational limitations.

Attached is the procedure established by COES to calculate the guaranteed power and this calculation for guaranteed power as performed by the project sponsor for Carhuaquero IV. The revenue allowances for power capacity and energy sales are described in the concession law.

Thus, as a consequence of low load factor, low tariff and the lack of revenue from guarantee power availability (capacity payment), the project without CERs is not economically attractive for the project sponsor. This situation is reflected in the low IRR of the project (a) (10.48%), which fails to approach the corporate (b) benchmark return of 14.29%[3], and further, does not even attain the discount rate of 12%[4] which is established by the government within the electric concession law to determine electric tariff and evaluate investments. To establish this situation conclusively, the IRR analysis is included with this document.

Regarding the IRR, prior to the starting date of the project, the project sponsor adjusted the schedule of the project investments: in the IRR spreadsheet, the distribution of the capital investment for 2006 was US$3,840,000, and in 2007, US$2,560,000. As a result of this apportionment, the IRR increased slightly to 10.48%

The tariff has been calculated accordingly as the weighted average, taking in account that the project faces different tariffs during the year (including high tariffs in the dry season and low tariffs during rain season). Since the project produces more energy in the rainy season, it receives a lower tariff than, for example, other hydro facilities, which dispatch on a constant energy production basis throughout the year.

The tariff was calculated using the same software that is used by the dispatch center (COES) and the regulator (OSINERG). In order to compare the consistency of this tariff with an independent party, the Ministry of Energy and Mines publishes in its web page a study called 'Electrical Referential Plan' regarding its expected expansion of the electric sector for the year 2006-2015[5].

[3] Hurdle rate for Peru of 14.29% determined by t he division of Pricing & Valuation of Duke Energy Americas. This hurdle rate was communicated to Duke Energy Peru through an e-mail dated on December 6, 2005. A copy of the e-mail has been provided to the DOE.

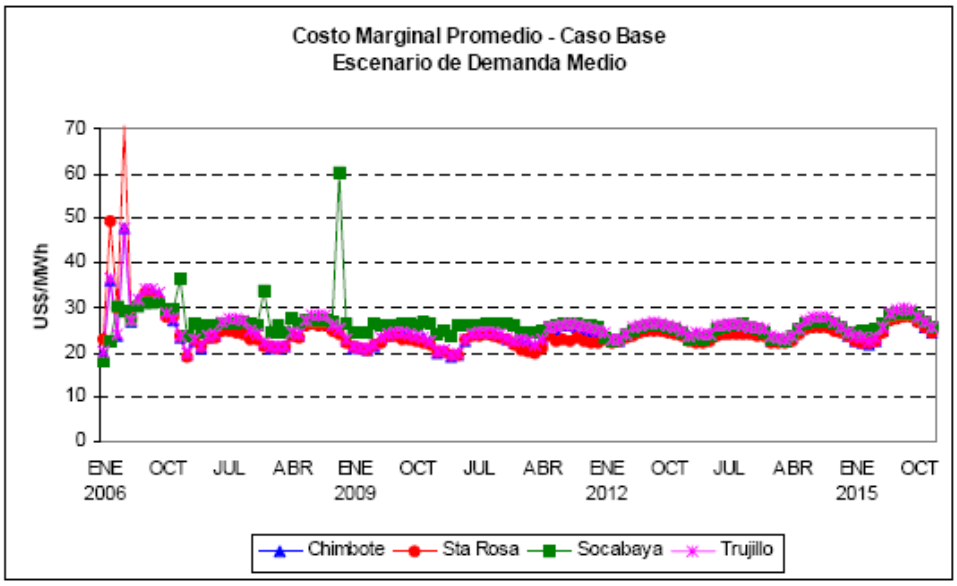
[4] A specific discount rate for the electric sector has been determined by the Ministry of Energy and Mines within the Peruvian Electric Concession Law, and is used principally by the electric sector regulator to determine electricity tariffs, as well as by the private sector to evaluate investments. This discount rate is 12% and was established considering investment risk of a thermoelectric peaking unit. It represents an official rate of discount for the Peruvian electric sector, and has been widely used for investment evaluations by both the private and the public sectors. It is considered to be a conservative discount rate since public investment is driven by social interests and often has access to attractive loan terms. In this analysis, the discount rate is used as a benchmark for the minimum rate of return expected by investors and borrowers in Peru. A copy of the concession law has been provided to the DOE.

[5] Source: Ministerio de Energia y Minas. "PLAN REFERENCIAL DE ELECTRICIDAD 2006 – 2015". Page 133. http://www.minem.gob.pe/archivos/dge/publicaciones/plan2006/03-PRE-2006_CAPITULO_3_V5.pdf

This study forecast the marginal cost for electricity generation and showed that the tariff are - on average - always below 30 cents per MW/h (even in the worst scenario), following a similar behavior to the marginal cost forecast by the project sponsor.

In the figure provide from that study below, the behavior of marginal costs is illustrated:

Gráfico N° 3.54



Source: Ministerio de Energia y Minas. "PLAN REFERENCIAL DE ELECTRICIDAD 2006 – 2015". Page 133.
http://www.minem.gob.pe/archivos/dge/publicaciones/plan2006/03-PRE-2006_CAPITULO_3_V5.pdf

Documentary documentary evidence for the assumptions used in the IRR calculation is provided as follow:

- The contribution to governmental institutions is focused on the contribution to the electric regulator, called OSINERG. This contribution is established in the Supreme Decree No. 136-2002-PCM which stipulates that the contribution will be 1% of sales. The document is attached.
- "Water Canon" is defined in the guidelines for the fulfillment of the electric concession law. In there it is established that 1% of the tariff goes to this contribution. The document is attached.
- The turbine overhauling cost has been calculated based on the experience of Duke Energy (with the existing plant located close to the project) and is based in the maintenance of the runner vanes which are expected to be worn out during operation.

IRR and Sensitivity Analysis:

The project failed to reach the established government benchmark of 12%, and which has now been used in the sensitivity analysis. This benchmark is actually more conservative than Duke's internal hurdle rate of 14.29% which was used in corporate decision-making. In terms of this validation

review, it is institutionally difficult to demonstrate the veracity of this internal discount rate; however, we maintain that this is the benchmark that was used by the company in their consideration of the project, and it should be emphasized that the project would fall far short of this metric without the presence of CERs.

A sensitivity analysis has been included in the IRR to see at which values for each sensitivity parameter the IRR corresponds with the benchmark. Three key parameters have been chosen as applicable for this exercise: Investment costs, Load factor, and Tariff. The results are:

Sensitivity Analysis Project IRR		
Turning point condition to overpass the benchmark of 12%		
-13% Inv.	+16% Tariff	+16% Load Factor

The probability of reaching this level of change in any of these individual parameters is considered to be impossible in practical terms. This is because: (i) the project investment cost was calculated taking into account quotations already budgeted which were the lowest available market quotes in order to make the project attractive for financing, more over, as the time passed on, the project cost has maintained as planned; (ii) a tariff increase is not likely since energy generation in Peru is becoming cheaper as a result of lower cost of natural gas as fuel and the entry into operation in the medium term of various natural gas-fired thermoelectric plants (as it can be seen in the study "Electrical Referential Plan year 2006-2015" of the Ministry of Energy and Mines mentioned before, as well as illustrated in the table below), and (iii) the load factor is not expected to increase since the projections have been performed with hydrology data of more than 40 years from the existing Cirato station. Please refer to the IRR model.

2. (EB) Further substantiation of the prevailing practice barrier is required, in particular further evidence is required to explain and substantiate the impacts of the gas discoveries on ongoing investment in hydro power.

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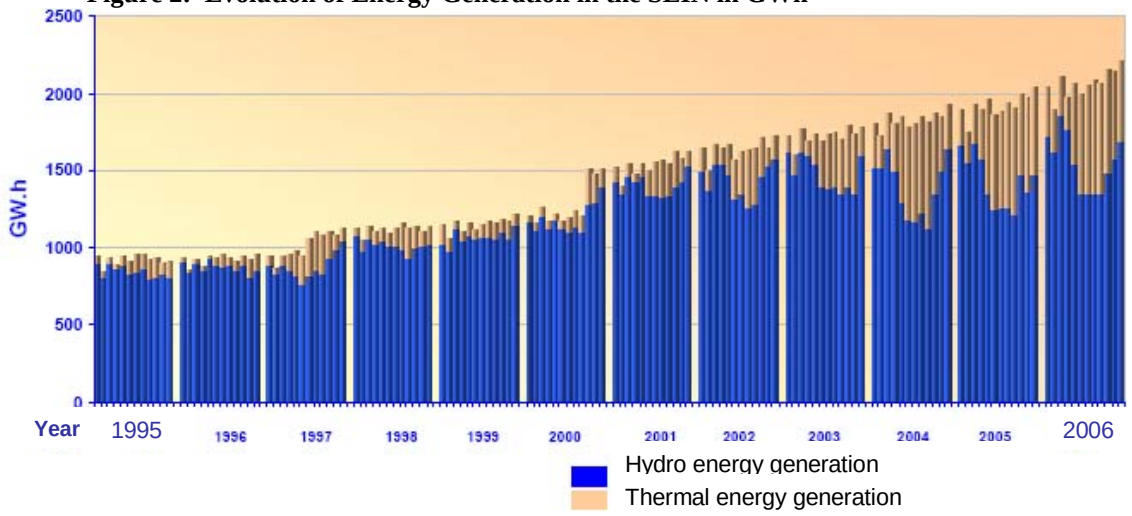
As explained in the prevailing practice barrier section of the PDD, the traditional electrical energy source in Peru has been hydropower. However, since 1998, as a result of the discovery of the substantial gas fields of Camisea6, governmental policy supporting exploitation of the natural gas deposits has shifted the overall trajectory for the Peruvian electricity sector. In support of the current and expected annual electricity demand growth rates of over 10%, natural gas has become the preferred choice for power generation in Peru.

[6] According to information contained on www.camisea.com.pe, "The San Martin and Cashiriari fields, jointly known as Block-88 (Camisea) are home to one of the most important non-associated natural gas reserves in Latin America. The Camisea reserves are ten times greater than all other existing natural gas reserves in Peru". Camisea was discovered between 1983 and 1987, but only became operational in August 2004. Since then, concession rights for the block 56 (Pagoreni), which would enlarge the proven reserves of natural gas in Peru, have also been granted for exploration and development.

Figure 2: Evolution of Energy Generation in the SEIN in GWh



Source: COES – Estadística de Operaciones 2006.

The Peruvian Government has been keen on developing the domestic natural gas market in order to attend to the growing energy demand and to attain energy self-sufficiency. With this intention, the Government has put forward a "Natural Gas Policy and Regulatory Framework", which contains provisions making it more attractive for private investors to invest in new natural gas-fired plants rather than in hydropower generation. This trend is expected to continue as more fields are discovered and more pipelines are built.

As described in the PDD, these provisions have been:

- By the beginning of 1998, the Government halted both the indefinite and the temporary concessions for hydropower generation through Law 26980 issued in September 1998, Law 27133 "Law of Promotion of the Natural Gas Industry" issued in June 1999, and Law 27239 issued in December 1999[7]. No hydropower generation concessions were granted in 1999[8], demonstrating that this sectoral policy shift has curtailed any new hydropower development while adding to the risks associated with hydropower generation in Peru, as perceived by local, as well as foreign investors.

- The guidelines for the implementation of the Law for the Promotion of the Natural Gas Industry (DS 031-2003-EM28.09.2003) were issued in August 28, 2003, and establishes that the price of natural gas is regulated, fixing limits for tariff calculations and rate increases, and guaranteeing a low tariff for local consumer such as power plants.

[7](1) 27 September 1998: Law 26980 – "Law that modified several articles and definitions annexed to ECL". On its third Transitory Disposition mandated the suspension for 9 months in the presentation of requests for temporal and definite concessions for hydropower plants. (2) 4 June 1999: Law 27133 – "Law of Promotion of the Natural Gas Industry" – On its Unique Complementary Disposition extended the suspension of hydropower plants for 12 additional months from June 1999. (3) 22 December 1999: Law 27239 – "Law that modified several articles of the ECL" - On its Unique Complementary Disposition mandated that priorities to admit new temporal and definitive concession in hydropower plants would be determined as a function of the national development.

[8] According to a list of definite concessions granted by Peru's Ministry of Energy and Mines (MINEM) in the last 10 years.

- Along with the commissioning of the Camisea Project in August 2004, the government issued laws DS 019-2004 on 25 June 20049, DS 041-2004-EM on 24 November 200410; and DS 107-2004-EF on 5 August 2004[11]; to promote natural gas-fired electricity generation and to exempt the selective consumption tax for natural gas. These 3 laws were aimed at making natural gas an even more competitive alternative for power generation.

- The government also issued several decrees[12] that lay out the security measures and ownership requirements for gas pipeline installations, paving the way for new investments.

- At a public declaration in August 2005[13], the Minister of Energy and Mines asserted the need to encourage the use of natural gas in all activities including electricity generation in order to offset rising oil prices. For this purpose, the Council of Ministers created a commission to prepare a strategic plan proposing a series of measures to further promote the use of natural gas. As part of this strategy, on 29 December 2005, the Government issued the decree on cogeneration, DS N° 064-2005-EM, encouraging simultaneous generation of heat and electricity using natural gas.

As a result of these measures, natural gas has been supported at promotional rates which have the effect of making thermal plants attractive while reducing the electric tariff (which make capital intensive projects such as hydroelectric less attractive). In the case of Carhuaquero IV, the low tariff affected it even more due to its low load factor. In contrast, a new thermal power plant - thanks to the low natural gas tariff - has a load factor of more than 85% because of its higher efficiency and lower cost of fuel than the existing carbon, diesel, residual thermal plants, and is highly in demand due to the high rate of energy demand growth throughout Peru.

As a consequence, the impact of the gas discoveries and government policy promoting natural gas has had a devastating effect on ongoing investment in hydro power.

The table below shows the new additions to the SEIN since 2004, the year in which the Camisea natural gas project was commissioned:

Additions to the SEIN from 2004 to 2007[14]

Enterprise	Power plant	Unit	Type	Effective installed Capacity (MW)	Date of Commissioning	Comments
EDEGEL	Ventanilla	TG3	Turbo Gas	164.1	08/09/2004	Natural Gas from Camisea

[9] Indicates that for the next 2 years after 25 June 2004, when the request for authorization is for natural gas-fired electricity generation, the guarantee required by article 66 of the ECL Rules will be reduced from 1% to 0.25% of total project budget , while the ceiling will be reduced from 500 UIT (Unidad Impositiva Tributaria) to 200 UIT.

[10] Supreme Decree that promotes the installation of thermal plants that use natural gas as fuel.

[11] Clarifies that natural gas is not affected by the Selective Consumption Tax (ISC).

[12] Supreme Decree 038-2004 on 21 October 2004; Supreme Decree 016-2004-EM on 10 June 2004; and Supreme Decree 018-2004-EM on 16 June 2004.

[13] Source: Ministerio de Energía y Minas. Dirección General de Electricidad "Informativo DGE n° 8" August 2005. page 5. http://www.minem.gob.pe/archivos/dge/estadisticas/informativo/InformativoDGE-8.pdf

[14] Registered projects are not included

		TG4	Turbo Gas	160.5	29/09/2004	Natural Gas from Camisea
EDEGEL	Santa Rosa Westinghouse	TG7	Turbo Gas	121.3	01/06/2005	Natural Gas from Camisea
ENERSUR	*Yuncan*		*Hydro*	*130*	*07/09/2005*	*Applying to the CDM*
EDEGEL	Santa Rosa UTI 5 & 6	UTI5, UTI6	Turbo Gas	109	01/06/2006 - 01/08/2006	Natural Gas from Camisea
EDEGEL	Ventanilla	TG3, TG4	Combined Cycle	450	01/10/2006	Natural Gas from Camisea
ENERSUR	Chilca TG1	TG1	Turbo Gas	175.96	01/12/2006	Natural Gas from Camisea
Kallpa Generacion	Kallpa	TG1	Turbo Gas	184	24/07/2007	Natural Gas from Camisea
ENERSUR	Chilca TG2	TG2	Turbo Gas	175.96	07/08/2007	Natural Gas from Camisea

Source: COES - The Peruvian dispatch Center

There is only one hydroelectric power generation project among the above additions to the SEIN, with Yuncan representing only 8% of the capacity additions. Besides, Yuncan is applying to the CDM and therefore its CDM status from conception prevents this project from being part of common practice in Peru

In addition, the following table provided by OSINERG (the Peruvian electric regulator) shows the power plants that were recently built or are under construction (this is the same information information from the PDD but it has been updated with information from COES from year 2007. In addition, the registered project of Cayahuanca has been removed).:

Power Plants Recently Built or Under Construction[15]

Enterprise	Power Plant	Unit	Type	Installed capacity (MW)	Expected Date of Commissioning	CDM status
CAHUA	PARIAC	G2, G3	Hydro	0.8	February 2007	
GLOBELEQ	KALLPA	TG1	Turbo Gas-Natural Gas	184	July 2007	
ENERSUR	CHILCA	TG2	Turbo Gas-Natural Gas	175	August 2007	
EGESUR	CALANA		Natural Gas	26	September 2007	

[15] Registered CDM projects are not included

GEPSA	*LA JOYA*		*Hydro*	*10*	*April 2008*	*In Validation*
SINERSA	*POECHOS II*		*Hydro*	*10*	*June 2009*	*Validated*
CAHUA	*PARIAC*	*G5,G6*	*Hydro*	*8*	*June 2009*	*Applying to the CDM*
EGASA	MOLLENDO		Natural Gas	73	August 2009	
EGESUR	CALANA		Natural Gas	26	October 2009	
ENERSUR	CHILCA	TG3	Turbo Gas-Natural Gas	175	November 2009	

(La Virgen is not considered because is not under construction. Caña Brava has not been included because is registered)

Source: OSINERG,"Estudio Técnico Económico de determinación de Precios de Potencia y Energía en Barras para la Fijación Tarifaria de Mayo de 2007 y 2008", http://www2.osinerg.gob.pe/gart.htm.

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As the table above illustrates, only 4% of installed capacity under construction is hydroelectric power generation, whereas the remaining 96% is natural gas-fired thermal generation. The fact that all of the hydropower projects are seeking CDM registration can be attributed to the barriers explained above, which prevent hydropower projects from being developed without CDM.

Based on these circumstances, the Project is not common practice, but rather, an exception that would likely not have materialized without CDM revenues. Thus, the Project is additional.

Reasons for declining contribution of hydro:

We have used the unit cost of power generation, but that apparently is not sufficient for the EB. We can perform a financial analysis of a typical case of a natural gas power thermal plant, but it could be subjective because each case is different and based on a different scale of project. This is why we have applied the benchmark analysis using the official benchmark of 12% to avoid subjectivity.

However, other relevant issues that we can describe regarding the favorable sectoral policy toward natural gas could include:

- Thermal plants benefit from significant revenues for their power capacity since they can guarantee energy production in any time of the year for almost their entire rated capacity, and can thus receive a capacity payment simply for being available
- In addition, a new power thermal plant has a load factor of more than 85% because of its higher efficiency (due to technological advances) and lower cost of fuel compared with the still existent older carbon, diesel, and residual thermal plants, and because of the growing demand for energy in Peru. Also, the investment cost and the duration of the construction is half of a typical hydro power plant. But, making a direct comparison is difficult and subjective also because thermal plants typically are bigger to the one of Carhuaquero IV and therefore are not directly comparable. Nonetheless, one large thermal plant could also delay the entry of several small projects.