

# Project Idea Note (PIN)

Name of Project: Recovery and utilization of associated gas to optimize power generation

Date submitted: 13 May 2009

## A. PROJECT DESCRIPTION, TYPE, LOCATION AND SCHEDULE

### OBJECTIVE OF THE PROJECT

*Describe in not more than 5 lines*

To enhance and optimize power generation using associated natural gas at the facilities of Petroamazonas (PAM), which are located in the Block 15 and oil fields know as Eden-Yuturi and Limoncocha at Ecuadorian Amazonian Region. Project activity is to reduce GHG emissions by recovering the associated gas from oil wells located in two areas Indillana, Limoncocha, Yanaquincha and Paka Sur (ILYP) and Eden Yuturi (EY).

### PROJECT DESCRIPTION AND PROPOSED ACTIVITIES

*About 1/2 page*

The Project of Optimization of Power Generation (OGE) will be implemented in two areas of Block 15 operated by PAM: Indillana, Limoncocha, Yanaquincha and Paka Sur (ILYP) and Eden Yuturi (EY). It is expected to have a generation capacity of 28, 16 MW (currently 4 MW with recovered gas) at ILYP and 34, 80 MW (currently 7, 8 MW with recovered gas) at EY with a total output of around 550.000 MWh per year.

In order to produce this energy, it is to use associated gas recovered from oil fields (around 15,37 MMSCFD of gas), which will substitute the use of diesel and crude oil that are now used to generate electricity at facilities. The project activity proposes to capture the associated gas produced from oil extraction activities in ILYP and EY areas. Currently, an important quantity of gas from the oil wells contemplated within this project activity is being flared. Therefore, the project consists of installing necessary infrastructure and devices to recover, transport, and generate electricity on-site using the captured natural associated gas.

At the ILYP area is expected to develop the main following activities:

Locations	Activities
Central Processing Facilities (CPF)	<ul style="list-style-type: none"> <li>• A new gas treatment plant will be installed, that will have a capacity to process the whole gas recovered from oil wells (7,5 MMSCFD) as well as gas coming from Limoncocha location (3,13 MMSCFD).</li> <li>• New devices to compress gas are to install (460 HP and 730 HP).</li> </ul>
Limoncocha	<ul style="list-style-type: none"> <li>• Enhancing of the existent compression system.</li> <li>• A pre-cooler (GC-2000) will be installed prior to the gas compression.</li> </ul>
Paka Sur	<ul style="list-style-type: none"> <li>• A new gas treatment plant will be installed with a capacity to process 1, 7 MMSCFD.</li> <li>• New devices to compress gas are to install (130 HP).</li> </ul>
Pipeline requests	<ul style="list-style-type: none"> <li>• A new pipeline will be constructed between Limoncocha and CPF (L= 12 km.). This pipeline will convey gas produced at new treatment plant in CPF.</li> </ul>

The EY component is currently being designed; however, the final objective is to enhance treatment capacity of associated gas up to 4,0 MMSCFD. Treated gas will be used to generate electricity that is produced with crude oil, at present.

#### TECHNOLOGY TO BE EMPLOYED

*Describe in not more than 5 lines*

The project will use the associated gas that is usually burned in flares. Associated natural gas will be recovered in order to be combusted to generate electricity, enabling this stored energy to be transformed into usable power.

Power production process begins with the extraction of oil, which brings associated gas, continues with gas treatment and transport to the power plants, and ends with its combustion in boilers and turbines to generate electricity. After the gas is separated, it is treated at gas plant to remove impurities such as hydrogen sulfide, helium, carbon dioxide, hydrocarbons, and moisture.

The Project activity will use a common approach that is to burn the gas in a combustion turbine to generate electricity. Combustion turbine is based on jet engines. With the combustion turbine technology, the gas is burned, creating superheated gas, which is then pressurized in pipes and used to drive the turbine.

A gas turbine consists of three main segments – (i) compressor (ii) combustor and (iii) turbine. Ambient air is compressed to 11-30 bar pressure and consequently its temperature rises. Most of this warm air is used in the combustor to burn the fuel (natural gas or a liquid e.g. oil etc.). The resulting hot gas expands through the turbine, and exits at nearly atmospheric pressure but with a temperature of up to 500-640 °C. Work extracted during the expansion is used to turn the turbine that drives the generator that produces electricity.

#### TYPE OF PROJECT

Greenhouse gases targeted  
CO<sub>2</sub>/CH<sub>4</sub>/N<sub>2</sub>O/HFCs/PFCs/SF<sub>6</sub>  
*(mention what is applicable)*

CO<sub>2</sub>

Type of activities  
Abatement/CO<sub>2</sub> sequestration

Abatement

Field of activities  
*(mention what is applicable)*  
*See annex 1 for examples*

6. Oil and gas sector  
6a. Flared gas reduction

#### LOCATION OF THE PROJECT

Country

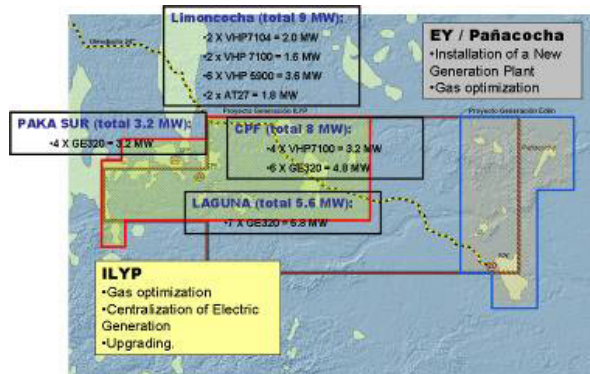
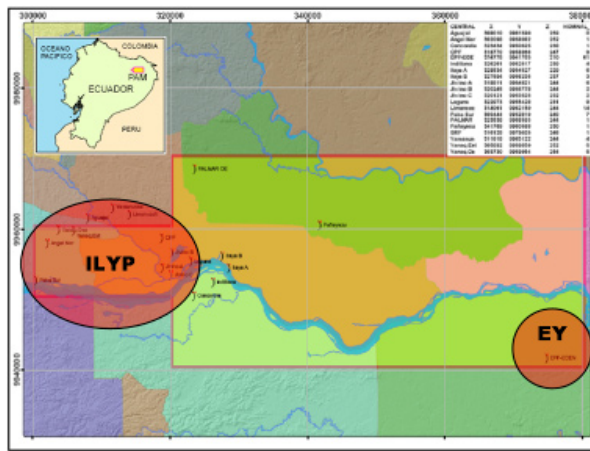
Ecuador

City

Shushufindi (Province of Sucumbíos)

Brief description of the location of the project  
 No more than 3-5 lines

The project activity is located at Ecuadorian Amazonian Region; specifically at the area operated by PAM known as Block 15. There are two main oil fields: Eden-Yuturi and Limoncocha. The Project location is situated between the provinces of Sucumbíos and Orellana and is surrounded by important hotspots of biodiversity and wildlife such as Cuyabeno Wildlife Reserve, Pañacocha Protector Cloudforest, Yasuní National Park and Limoncocha Biological Reserve.



PROJECT PARTICIPANT

Name of the Project Participant

Petroamazonas Ecuador S. A.

Role of the Project Participant

- a. Project Operator
- b. Owner of the site or project
- c. Owner of the emission reductions
- d. Seller of the emission reductions
- e. Project advisor/consultant
- f. Project investor
- g. Other, please specify: \_\_\_\_\_

Organizational category	<ul style="list-style-type: none"> <li>a. Government</li> <li>b. Government agency</li> <li>c. Municipality</li> <li>d. Private company</li> <li>e. Non Governmental Organization</li> <li>f. Other, please specify: Public Company</li> </ul>																
Contact person	Berend Van Den Berg, Project Manager																
Address	Av. Naciones Unidas E7-95 y Av. De los Shyris, Edif. Banco del Pacífico, Pisos 3, 4 y 5																
Telephone/Fax	(+593 2) 24 67 500, (+593 2) 29 93 700, (+593 2) 29 93 701																
E-mail and web address, if any	www.petroamazonas.ec																
Main activities <i>Describe in not more than 5 lines</i>	Petroamazonas Ecuador S. A. is a public company, which in August 2008 signed a contract for provision of specific services with Petroecuador and Petroproducción – state owned oil companies. The objective of this contract is to manage and operate oil fields and deposits located in Block 15 and Unified Fields Edén-Yuturi and Limoncocha, Pacay, Quilla, Aguajal y Pañacocha; as well as rest of the areas and fields determined by Petroecuador. Petroamazonas' operations have accomplished some management systems certified by DNV: Quality ISO 9001:2000, Environmental ISO 14001, and Occupational Health and Safety OHSAS 18001.																
Summary of the financials <i>Summarize the financials (total assets, revenues, profit, etc.) in not more than 5 lines</i>	<p><b>FIGURES OF PETROAMAZONAS ECUADOR S. A.</b></p> <table border="1"> <thead> <tr> <th>Detail</th> <th>April 2009 (\$)</th> </tr> </thead> <tbody> <tr> <td>Napo Crude Avg. Price \$ / barrel</td> <td>33</td> </tr> <tr> <td>Production (barrels per day)</td> <td>100,739</td> </tr> <tr> <td>Total production (barrels)</td> <td>9,066,534</td> </tr> <tr> <td>Revenues</td> <td>299,195,632</td> </tr> <tr> <td>Costs</td> <td>(41,761,386)</td> </tr> <tr> <td>Investments</td> <td>(148,677,676)</td> </tr> <tr> <td>Total Income (First quarter 2009)</td> <td>108,756,570</td> </tr> </tbody> </table>	Detail	April 2009 (\$)	Napo Crude Avg. Price \$ / barrel	33	Production (barrels per day)	100,739	Total production (barrels)	9,066,534	Revenues	299,195,632	Costs	(41,761,386)	Investments	(148,677,676)	Total Income (First quarter 2009)	108,756,570
Detail	April 2009 (\$)																
Napo Crude Avg. Price \$ / barrel	33																
Production (barrels per day)	100,739																
Total production (barrels)	9,066,534																
Revenues	299,195,632																
Costs	(41,761,386)																
Investments	(148,677,676)																
Total Income (First quarter 2009)	108,756,570																
Summary of the relevant experience of the Project Participant <i>Describe in not more than 5 lines</i>	<p>Although core business of Petroamazonas is not power generation, supply energy is a key issue to produce oil. For this reason, Petroamazonas has established a Group of Optimization of Power Generation (OGE) that designed a Project to improve using of non-renewable resources; recovery and utilization of associated gas to generate power.</p> <p>OGE Group is a small specific team within the organizational structure of Petroamazonas inside Facilities and Construction Department.</p>																

## EXPECTED SCHEDULE

Earliest project start date <i>Year in which the plant/project activity will be operational</i>	October 2009
Estimate of time required before becoming operational after approval of the PIN	Phase I: 8 months Phase II: 12 – 16 months Phase III: 36 months
Expected first year of CER/ERU/VERs delivery	September 2010
Project lifetime <i>Number of years</i>	15 years
For CDM projects: Expected Crediting Period 7 years twice renewable or 10 years fixed	10 years fixed
Current status or phase of the project	PAM has finished with the definition project phase; whereby, Phase I will initiate on May 2009. Phase II and III are at the engineering stage.
Current status of acceptance of the Host Country <i>Letter of No Objection/Endorsement is available; Letter of No Objection/Endorsement is under discussion or available; Letter of Approval is under discussion or available</i>	The Letter of Approval, as well as a Letter of Endorsement, will be requested at a later stage of project development. However, PAM has submitted a letter to inform to DNA about the commencement of the project activity and the intention to seek the CDM status.
The position of the Host Country with regard to the Kyoto Protocol	<ul style="list-style-type: none"> <li>• Ecuador ratified the “UN Framework Convention on climate Change” on November 7, 1994 (R.O. #562).</li> <li>• Ecuador ratified the Kyoto Protocol on December 20, 1999 (R.O.#1588).</li> <li>• The Ministry of the Environment is the Ecuadorian CDM Designated National Authority.</li> </ul>

## B. METHODOLOGY AND ADDITIONALITY

<p>ESTIMATE OF GREENHOUSE GASES ABATED/ CO<sub>2</sub> SEQUESTERED</p> <p><i>In metric tons of CO<sub>2</sub>-equivalent, please attach calculations</i></p>	<p>Annual (if varies annually, provide schedule) --- see Annex II for expected annual reductions</p> <p>Up to and including 2012: 476.324 tCO<sub>2</sub>-equivalent Up to a period of 10 years: 927.296 tCO<sub>2</sub>-equivalent</p>
<p>BASELINE SCENARIO</p>	<p>The baseline scenario is the situation where, in the absence of the project activity, the emissions would be greater because plenty quantities of associated natural gas to oil production is inefficiently burned in the flares.</p>
<p>ADDITIONALITY</p> <p>Please explain which additionality arguments apply to the project:</p> <p>(i) there is no regulation or incentive scheme in place covering the project</p> <p>(ii) the project is financially weak or not the least cost option</p> <p>(iii) country risk, new technology for country, other barriers</p> <p>(iv) other</p>	<p>In the absence of the CDM incentives, the project activity would not happen and the emissions would be greater than that of the project scenario, because the associated gas would continue being flared instead of being utilized to generate energy on-site. This project activity might have issues with additionality because of the following reasons:</p> <ul style="list-style-type: none"> <li>• Compared to conventional applications (diesel and crude oil generators), higher costs due to develops infrastructure and adjunct equipment to recover, treat and deliver associated gas to produce electricity.</li> <li>• Quantity and quality of gas to produce electricity cannot be warranted. These issues depend on the production of crude oil as well as the reservoirs where oil extracted comes from. Although with 3D seismic technology projections are more accurate, issues such as production of crude oil, gas to oil ratio, and, therefore, quantity and quality of gas available are either very changeable, or difficult to forecast.</li> </ul> <p>Nevertheless, there also are some arguments in favor of the project's additionality:</p> <ul style="list-style-type: none"> <li>• The incentive provided by the CDM has helped the project to be considered by Petroamazonas' managers;</li> <li>• The increase in gas consumption cannot be achieved if the infrastructure necessary for supplying additional quantities of gas is not in place;</li> <li>• In Ecuador, oil industry is become used to flare (or vent) the associated natural gas instead of being utilized to produce electricity. As was analyzed, uncertainties regarding to availability of gas is an important reason to exclude gas generators. In the other hand, for oil producing companies, there are not enough merits to justify investments to produce energy exclusively with gas recovered. In some cases, oil companies can have useless assets if the quantity or quality of gas does not conform to the indexes used to justify investment ("stranded asset").</li> <li>• In addition, there are no national or local regulations that require recovering and utilization of associated natural gas in any sector.</li> </ul>

## SECTOR BACKGROUND

- According to data updated to 2007, Ecuador's energy mix is still largely dependent upon oil, which represented 83 percent of the country's total energy consumption; hydroelectric power represented 7 percent of total energy consumption in 2005, and it is the largest source of electricity generation. Natural gas consumption is small 4%, due to the lack of domestic infrastructure to transport and distribute the fuel.
- Ecuador's oil industry produces a significant amount of natural gas as part of their operations: oil companies produced 118 MMSCFD of natural gas during the first half of 2007. However, most of that natural gas is flared, due to a lack of infrastructure to capture and use it.
- Ecuador's lack of infrastructure to develop natural gas reserves or capture associated gas production is a contributing factor to the imbalance in its refined product trade. For example, natural gas could provide an alternative for imported LPG, which is principally used for residential heating and cooking. In addition, increased natural gas production could supply more gas-fired power plants, replacing diesel or crude oil generators<sup>1</sup>.
- The main environmental regulation that applies to the project is the "Reglamento Sustitutivo del Reglamento Ambiental para las Operaciones Hidrocarburíferas 13 de febrero 2001" under the general national Environmental Law of 1999 and the Hydrocarbon Law of 1978. By the other hand, the Ministry of Environment prepared in 1999 a National Environmental Strategy for Sustainable Development that promotes the efficient utilization of natural resources.

## METHODOLOGY

Please choose from the following options:

AM009 Version 4 "Recovery and utilization of gas from oil wells that would otherwise be flared or vented" is applicable to the Project Activity because of the following considerations:

- Under the project activity the recovered gas is consumed on-site to meet energy demands

In the baseline scenario, it is the continuation of the following practices:

- Flaring of the associated gas
- Operation of the existing oil and gas infrastructure without processing of any recovered associated gas.

<sup>1</sup> Ecuador Energy Data, Statistics and Analysis - Oil, Gas, Electricity, Coal – Country Analysis Briefs, Energy Information Administration (EIA), April 2008.

## C. FINANCE

### TOTAL CAPITAL COST ESTIMATE (PRE-OPERATIONAL)

Development costs	2,955,663
Installed costs	84,096,635
Land	
Other costs (please specify)	
Total project costs	87,052,298

### SOURCES OF FINANCE TO BE SOUGHT OR ALREADY IDENTIFIED

#### Equity

Name of the organizations, status of financing agreements and finance (in US\$ million)

#### Debt – Long-term

Name of the organizations, status of financing agreements and finance (in US\$ million)

#### Debt – Short term

Name of the organizations, status of financing agreements and finance (in US\$ million)

#### INDICATIVE CER/ERU/VER

##### PRICE PER tCO<sub>2</sub>e

*Price is subject to negotiation.*

*Please indicate VER or CER preference if known.*

### TOTAL EMISSION REDUCTION PURCHASE AGREEMENT (ERPA) VALUE

A period until 2012 (end of the first commitment period)

A period of 10 years

A period of 7 years

Preliminary additionality analysis is presented in Annex II.

## D.EXPECTED ENVIRONMENTAL AND SOCIAL BENEFITS

### ENVIRONMENTAL ASPECTS

#### LOCAL BENEFITS

E.g. impacts on local air, water and other pollution.

- Recovery of gas from flares reduces pollution from switching to a cleaner fuel.
- Gas flaring reduction avoids release of a large number of pollutants because improper combustion as indicated by smoke from the flare stack, contributes to increasing the hazardous chemicals released into the environment including volatile organic compounds.
- Gas flaring reduction diminishes exposure of Amazonian endemic insects to be hot, because the flame at the flare stack attires them.

#### GLOBAL BENEFITS

Describe if other global benefits than greenhouse gas emission reductions can be attributed to the project.

- Project contributes to global efforts to limit CO<sub>2</sub> and CH<sub>4</sub> emissions with the objective of preventing climate change.
- CO<sub>2</sub> emission reductions not only benefit to Ecuador (host country of this project), but constitutes a contribution to the global community by reducing the risk of damage to human health, water systems, agriculture, amongst others sectors resulting from climate change.

### SOCIO-ECONOMIC ASPECTS

What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project? Indicate the communities and the number of people that will benefit from this project.

*About ¼ page*

- It will provide economic savings to by reducing the costs of operation of Petroamazonas from using diesel or crude oil to generate electricity.
- Ecuador is a crude oil exporter; however, its refining capacity of fossil fuels is currently not enough to supply national demand. For example, in 2006, energy imports (fuels and electricity) reached 22% of the whole importations compared to 9% in 1997. Hence, fuel-switching project will help to decrease the consumption of imported diesel, releasing a part of the country's imported fuels burden.
- It will avoid a waste of valuable resources (associated gas), because inefficiently flaring of gas will be replaced by energy generation at Petroamazonas facilities. Furthermore, gas will displace generation with imported fossil fuels such as diesel.
- Flare gas will replace diesel and crude oil; thereby the benefit is the sum of the abated emissions from previous flaring plus the benefits of lower emissions from gas relative to diesel/crude oil.

What are the possible direct effects (e.g. employment creation, provision of capital required, and foreign exchange effects)?

*About ¼ page*

- The project could demonstrate the use of a mechanism for co-funding environmentally friendly technologies, in this case, CDM which reduces emissions of GHG.
- Petroamazonas will be engaged to an international certification process (carbon certification), which is to demonstrate that company are committed to meet operations sustainably.

What are the possible other effects (e.g. training/education associated with the introduction of new processes, technologies and products and/or the effects of a project on other industries)?

*About ¼ page*

- It will provide the required expertise to Petroamazonas to identify and pursue additional CDM projects within its operations.
- Technology transfers to the oil sector and other related sectors as well as a "demonstrative effect" regarding to the use of a wasted resource such as flared gas.

# Annex I - Technologies

1. Renewables
  - 1a. Biomass
  - 1b. Biogas
  - 1c. Bagasse
  - 1d. Wind
  - 1e. Hydro
  - 1f. Geothermal
  - 1g. Photovoltaic
  - 1h. Solar Thermal
2. Fossil Fuel Switch
3. Energy Efficiency
  - 3a. Cement Efficiency Improvement
  - 3b. Construction material
  - 3c. District heating
  - 3d. Steel Gas Recovery
  - 3e. Other Energy Efficiency
4. Waste Management
  - 4a. Landfill Gas recovery/utilization
  - 4b. Composting
  - 4c. Recycling
  - 4d. Biodigestor
  - 4e. Wastewater Management
5. Coalmine/Coalbed Methane
6. Oil and Gas Sector
  - 6a. Flared Gas Reduction
  - 6b. Reduction of technical losses in distribution system
7. N<sub>2</sub>O removal
8. HFC<sub>23</sub> Destruction
9. SF<sub>6</sub> Recovery
10. Transportation
  - 10a. Fuel switch
  - 10b. Modal switch
11. Others

## Annex II. Preliminary additionality analysis

### 1.a Potential emissions reductions (2009 – 2019)

EFy	tons of CO <sub>2</sub>	8.968	139.407	181.144	146.804	119.962	97.029	77.644	60.960	46.315	33.189	15.873
-----	-------------------------	-------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------

*Average 10 years*            92.730  
*Total 10 years*            927.296

### 1.b Preliminary financial analysis

#### Key Assumptions:

Project lifetime:                    15 years  
Expected Crediting Period:        10 years starting in 2009

a. Without CERs: not applicable (CERs assumed to be only source of revenue)

This file shall be requested to Petroamazonas Ecuador S.A.