



REQUEST FOR CEO APPROVAL
PROJECT TYPE: Medium-Size Project
TYPE OF TRUST FUND: GEF Trust Fund

PART I: PROJECT IDENTIFICATION

Project Title:	Promotion of Industrial Energy Efficiency in Colombian Industries		
Country(ies):	Colombia	GEF Project ID:	5828
GEF Agency(ies):	UNIDO	GEF Agency Project ID:	140122
Other Executing Partner(s):	Mining and Energy Planning Unit (UPME) Administrative Department for Science, Technology and Innovation (Colciencias)	Submission Date:	05/08/2015
		Re-submission Date:	06/15/2015
GEF Focal Area(s):	Climate Change	Project Duration (Months):	36
Name of parent programme (if applicable):	N/A	Project Agency Fee:	160,788

A. FOCAL AREA STRATEGY FRAMEWORK:

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount (\$)	Co-financing (\$)
CCM-1	Enabling policy environment and mechanisms created for technology transfer	National strategies for the deployment and commercialization of innovative low-carbon technologies adopted	GEFTF	811,666	3,069,898
CCM-2	Appropriate policy, legal and regulatory framework adopted and enforced	Energy efficiency policy and regulation in place	GEFTF	226,667	600,000
CCM-2	Appropriate policy, legal and regulatory frameworks adopted and enforced	Energy savings achieved	GEFTF	654,167	14,200,000
Total Project Cost				1,692,500	17,869,898

B. PROJECT FRAMEWORK

Project Objectives:

Strengthen the technical and financial capacities of relevant stakeholders to enable the scale up of the energy efficiency (EE) measures which have been piloted by nationally driven programmes

Project Component	Grant Type	Expected Outcomes	Expected Outputs	Trust Fund	Grant Amount (\$)	Co-financing (\$)
1. Standards and Technical Regulations	TA	The national institutions develop the mandatory regulations, voluntary standards to support and Monitoring and Evaluation (M&E) schemes to support the adoption of EE measures in industries	<p>1.1 Revision of the legal EE framework, focused on technical regulations for labeling of boilers (manufacturing, labeling and operation)</p> <p>1.2 Awareness raising and dissemination of technical regulation amongst users</p> <p>1.3 National energy implementer and energy auditor certification schemes are defined, and institutions which can assess conformity are identified</p> <p>1.4 Piloting of the personnel certification programme is made, focusing on trainees from the "Comprehensive Energy Management System" (CEMS)</p> <p>1.5 Design of a Monitoring and Evaluation (M&E) scheme for EE measures</p>	GEFTF	190,000	450,000
2. Scale up the programme "Comprehensive Energy Management System" (CEMS) to national level (managerial and technical skills)	TA	The development of industry specific capacities is promoted, establishing a cadre of highly specialized energy management experts from the public and private sectors; which are available as a long-term technical resource to industry and the country	<p>2.1 A dedicated training on energy management for 200 enterprise managers and financial managers</p> <p>2.2 50 EE professionals received Energy Management Systems (EnMS) implementer level training, which includes classroom and practical training (practical training results in the implementation of EnMS in</p>	GEFTF	345,000	900,000

			50 enterprises) 2.3 Scale up of the CEMS to selected manufacturing regions and industrial subsectors 2.4 The awareness of 500 industrial entities of new regions/sectors on is raised			
	INV		2.5 At least 150 entities implement and develop energy management plans, leading to improved energy performance.		200,000	2,000,000
3. Transfer of system optimization technologies	TA	Strengthened technical capacities on audit and system optimization for energy end-use leading to measurable energy savings in industrial facilities	3.1 System optimization training and web-based tools are developed 3.2 75 EE professionals received implementer level system optimization training (25 for each type of system: motors, steam and pumps) 3.3 Awareness level training on systems optimization offered by trained local experts to 400 industry representatives, including 75 supply-chain partners and the 200 entities from Component 2	GEFTF	300,000	739,898
	INV		3.4 At least 45 in-depth energy system assessments are completed in manufacturing facilities to identify system optimization measures (15 for each type of system: motors, steam and pumps)		250,000	2,500,000
	TA		3.5 Monitoring and Verification (M&V) systems are applied to selected enterprises		87,500	180,000
4. Promotion of financial mechanism for investment	TA	A national financing scheme for the implementation of	4.1 The existing national financing schemes for EE measures are evaluated	GEFTF	150,000	10,700,000

promotion at enterprise level		EE measures in the industrial sector is assessed and financing institutions are strengthened to assess IEE projects	<p>4.2 At least 2 financing schemes for the Colombian industrial entities are designed, strengthening the tools used by the investment banks</p> <p>4.3 A portfolio of investment projects is created with EE projects identified in the activities of outputs 2.5 and 3.4 for each financing scheme designed</p> <p>4.4 Management for the implementation of the designed financing schemes for the projects identified in the portfolio, sustaining the task of banks</p>			
5. Monitoring & Evaluation (M&E)	TA	A robust mechanism for M&E is put in place to ensure the attainment of project outcomes	<p>5.1 The project M&E plan is designed and executed</p> <p>5.2. Final project evaluation is conducted</p> <p>5.3. Follow up actions and recommendations are determined for long term project sustainability</p>	GEFTF	60,000	100,000
Subtotal					1,582,500	17,569,898
Project Management Cost				GEFTF	110,000	300,000
Total Project Cost					1,692,500	17,869,898

C. SOURCES OF CONFIRMED CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME (\$)

Source of co-financing	Name of Cofinancier (source)	Type of co-financing	Amount (\$)
National government	Mining and Energy Planning Unit (UPME)	In cash	4,600,000
		In kind	40,000
National government	Administrative Department for Science, Technology and Innovation (Colciencias)	In kind	17,007
National government (academia)	Colombian Knowledge Network on Energy Efficiency (RECIEE)	In kind	97,789
Private Sector	Colombian Entrepreneurial Development Bank (Bancoldex)	In cash	12,725,102
Private Sector	International Copper Association (ICA) Latin America	In kind	30,000
GEF Agency	UNIDO	In cash	60,000
		In kind	300,000
Total co-financing			17,869,898

Full details on the co-financing are provided in Annex H.

D. GEF/LDCF/SCCF/NPIF RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY

The proposed project is for a single focal area, single country, single GEF Agency and single trust fund.

E. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	Grant Amount (\$)	Co-financing (\$)	Project Total (\$)
International consultants	190,000	0	190,000
National/Local Consultants*	495,000	695,000	1,190,000

*Details are provided in Annex F. Local subcontracts amount to \$ 600,000

F. DOES THE PROJECT INCLUDE A “NON-GRANT” INSTRUMENT? No

(If non-grant instruments are used, provide an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/NPIF Trust Fund).

PART II: PROJECT JUSTIFICATION

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN OF THE ORIGINAL PIF¹

A.1. National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, national communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.

As described in the PIF, the main policy framework, strategies and plans, which define the context of energy efficiency (EE) in industry in Colombia, are:

- the “Programme for the Rational and Efficient Use of Energy” (PROURE); which promotes the implementation of EE measures throughout the energy supply chain. This law has been regulated by decrees 3683 of 2003 (amended by decree 2688 of 2008) 2501 and 2007 which set special provisions for the adoption of EE measures. These provisions include the creation of an Intersectoral Commission for the Rational and Efficient Use of Energy (CIURE) as an advisor to the Ministry of Mines and Energy body for decision making in the field. A key milestone in the development of EE regulation was the issuance of Resolution 180919 of 2010 by which the Ministry of Mines and Energy adopted the 2010-2015 action plan to implement the PROURE. The action plan defines specific subprogrammes, priority activities and targets. The action plan defines specific subprogramme, priority activities and targets.
- the Colombian Low Carbon Development Strategy (CLCDS of 2012) has identified during 2013 that emission reductions in the industrial sector are a priority area. The CLCDS call for the development of NAMAs for EE in industry.
- a national programme denominated "Comprehensive Energy Management System" (CEMS), was established to raise awareness, train and disseminate Energy Management Systems (EnMS), focused on developing technical capacities. This programme was adopted in the period 2010-2013 and was jointly executed by the Administrative Department of Science, Technology and Innovation (Colciencias), the Mining and Energy Planning Unit (UPME); and financed by the energy utilities.
- fiscal incentives established in the national fiscal policy (law no. 223 from 1995 and administrative amendments) creating a mechanism to provide fiscal incentives, including VAT elimination and income tax reduction, of equipment and elements for environmental monitoring and control, focusing on noxious pollutants to the environment.

In addition, the following regulations which are relevant to the project design have been issued during the design phase (2014):

a. National Development Plan 2014-2018.

The National Department of Planning (NDP) has published a draft law, the National Development Plan (ND Plan) 2014-2018. This document, currently under debate, sets revised energy use targets for the period 2014-2018, and is based on the results of the last four years (2010-2014)².

The plan considers a number of scenarios, in which the achievement of energy savings through the adoption EE measures in the industrial, services, public building, residential and transport sectors are considered. The draft

¹ For questions A.1-A.7 in Part II, if there are no changes since PIF and if not specifically requested in the review sheet at PIF stage, then no need to respond, please enter “NA” after the respective questions.

² Available in Spanish <https://colaboracion.dnp.gov.co/CDT/Prensa/PND%202014-2018%20Bases%20Final.pdf>

version of the ND Plan proposed a scenario in which the average annual economic growth of the industrial sector is of 4.5%.

Furthermore, the following energy saving targets are considered in the draft version of the ND Plan:

Year	2015	2016	2017	2018
Energy savings	1.75%	3.48%	5.21%	6.91%

These energy saving targets are more stringent than those presented at the PIF document for 2010-2014. These targets are based on the calculated growth for each sector and consider EE improvements, particularly in the subsectors of beverages and tobacco, paper and printing, chemical, cement, iron, steel and non-ferrous ores, which have been identified as the most energy-intensive manufacturing sectors. These industrial subsectors are present in the selected regions of coverage for the proposed project.

The energy savings estimated by the draft version of the ND Plan would be achieved as a result of the implementation of measures focused on the following technologies:

- efficiency improvements of gas or solid fuel fired pyro-tubular boilers,
- replacement of heating technologies based on steam transport by direct heat application technologies produced by decentralized sources, and
- mandatory use of electric motors compliant with minimum efficiency standards (and banning the use of inefficient motors).

The Draft ND Plan also states that the proposed measures should be reinforced by information policies, such as research, awareness and promotion of rational use of energy.

b. New Law on "Integration of the renewable non-conventional energy source into the national energy system" (Law no. 1517 of 2014)

This law, while mainly focused on renewable energy (RE), explicitly mentions the need for efficient management of energy; which is described as EE and demand management. Furthermore it promotes the reduction of the greenhouse gas (GHG) emissions.

The key aspects of Law 1517, which are relevant to the proposed project, are that the PROURE remains the national policy instrument for the EE promotion; and that a sectorial action plan for EE improvement should be developed. Such plans should have a positive effect in promoting EE, because they will enable the adoption of EE measures, set a time frame for implementation of these measures, define the responsibilities for public entities and identify different forms of financing and the budgetary needs.

c. Technical Regulation on Boilers

Following a four year drafting process, on November 26 2014, the Ministry of Mines and Energy (MinMinas) held a consultation meeting with relevant stakeholders to discuss a Draft Technical Regulation on Boilers.

The proposed Draft was initially developed by the Ministry of Labor to address occupational safety aspects, but was also revised by the Ministry of Mines and Energy to consider energy related issues. The Ministry of Mines and Energy has incorporated new definitions and sections in the Draft, that promote EE for boiler design, manufacture and installation. The Draft does not address energy efficient operation nor steam systems considerations.

The art. 74 of the Draft Technical Regulation considers rational use of energy and requires the selection of “the appropriate boiler”, operating it under “optimal combustion “conditions, and implanting at least one of six heat

recovery measures. All of these requirements are qualitative, since they do not impose a concrete and measurable efficiency level and do not define how to select an appropriate boiler.

It is worth noting that boilers are also subject to regulations from the Ministry of Environment and Sustainable Development (MinAmbiente) which establish the need for mandatory testing of combustion efficiency and maximum surface temperatures. With these tests, the boiler efficiency is indirectly checked, but there is no explicit control of operational parameters. A positive aspect of the regulation is the requirement of competency certificates for operators, based on boiler size.

d. Voluntary standards

The ISO published on November 2014 the ISO 50003 which specifies requirements for bodies providing auditing and certification of EnMS under the ISO 50001. This voluntary standard has an impact on the capacities that certification bodies should have, and which should be considered by the National Accreditation Bodies under which the conformity assessors should be accredited.

e. Detailed energy characterization

In the period 2013-2014, the UPME contracted services to conduct a thorough assessment of energy use and energy saving potential by industrial subsector³. Those studies were led by two research teams, which were responsible for surveying and analyzing the data from 9257 enterprises. These detailed assessments provide UPME with a better understating of energy use by subsector. The data and results of the analyses have been used for the detailed global environmental benefits calculation and are presented in Annex E.

A.2 GEF focal area and/or fund(s) strategies, eligibility criteria and priorities

As described in the PIF document, and on the basis of the “GEF 5 Programming Document”, dated May 12, 2010, the project is in compliance with the Climate Change Mitigation (CCM) Results Framework Objective #2 “Promote market transformation for energy efficiency in industry and the building sector”. The GEF recognizes UNIDO’s comparative advantage, as an implementing agency, in the development of projects for the industrial sector focusing on EE, as well as its knowledge of small and medium enterprises (SMEs) in both developing and transition economy countries.

A.3 The GEF Agency’s comparative advantage

UNIDO's Industrial Energy Efficiency (IEE) project builds on more than three decades of experience and unique expertise in the field of inclusive and sustainable industrial development (ISID). Combining the provision of policy development support services and capacity-building for all market players, UNIDO aims for removing the key barriers to continuous improvement of EE in industries and ultimately transforming the market for IEE. UNIDO's IEE project assists developing countries and emerging economies by providing technical assistance and advice on policy-making, capacity-building and market transformation. UNIDO's IEE project supports the adoption and implementation in industry of EnMS and system optimization, as a way to enact its ISID strategy.

Therefore, UNIDO is well placed to implement this project due to its experience and expertise in promoting EnMS standards. UNIDO has promoted the development of the ISO-50001 standard (EnMS); and to date, UNIDO has developed and implemented similar IEE projects in 16 countries around the world. In Latin America, a similar project is being implemented in Ecuador (GEF project ID 4147), and lessons learned from its project

³ Industrial subsectors in Colombia are classified based on a nationally adapted version of International Standard Industrial Classification of All Economic Activities, ISIC

implementation have been shared during a bilateral exchange meeting in Quito between the executing agencies of both projects in June 2014; and properly considered in the development of this CEO Approval Request document.

UNIDO has a regional office in Colombia with 7 staff: 3 professional staff with extensive project management experience, 4 general service staff, three of whom have extensive experience in administrating projects.

UNIDO's co-financing is of \$ 360,000. These funds take into account the training and the use of the training programme on system optimization for motors, steam and pumping systems, as well as technical inputs from different units within UNIDO, namely the Compliance Infrastructure Unit, providing guidance on national quality infrastructure and polices and the EE Unit, providing guidance on the development of the heat recovery optimization training package. The breakdown of in kind cofinancing is provided in Annex F.

UNIDO's capacities and fit within the country programme have not changed in comparison with the PIF document.

A.4 Baseline project and the problem that it seeks to address

The following section provides an abridged analysis of the issues presented at the PIF stage and provides a detailed analysis of the new policy instruments which have been introduced during the design phase. For a detailed description of policies and programmes refer to Annex J Policy Framework.

Background and problem analysis

Energy intensity in the Colombian economy was of 0.380 barrels of oil equivalent (boe) per \$ 1,000. In 2011, energy consumption was 1,100,042 Terajoules, with the industrial sector representing 25.1% of the national energy consumption (UPME 2012).

In the industrial sector, that represents about 25% of national energy consumption, significant energy saving opportunities have been identified. In an assessment of technical saving potentials, the main opportunities are as follows: 25% savings for heat transfer, 27% for steam generation and 28% for motor systems. The subsectors with the mayors consumption are Food, Beverage and Tobacco; Cement and Chemicals. The energy use in the industrial sector and its savings potential has been recently characterized by in-depth assessments on energy conducted by UPME in 2013-2014.

In the past four years the Government entities which have promoted EE in industry have focused its effort on awareness raising and dissemination measures. In that regard, the National Government has succeeded in raising awareness of the concept of EnMS as a management tool, particularly for the industry sector. This is a key achievement of "Comprehensive Energy Management System" (CEMS) Programme, which has conducted extensive training but has some shortcomings in adoption at enterprise level.

As described in section A.1 the development of national EE laws and regulations is currently at a crucial moment. To comply with its obligations, the National Government has proposed to the National Congress the National Development Plan (the "ND Plan") for the period 2014-2018. This policy review is taking place in a geopolitical context of declining oil prices and uncertainty about the energy autonomy of Colombia in the near future. The ND Plan refers to "energy efficiency" in a number of sections, but those references are not yet translated into policy instruments or programmes; while there are detailed action plans for the expansion of power generation and the use of non-conventional energy sources.

A similar analysis can be made of new Law no. 1715 of 2014 regulating the integration of the non-conventional energy sources to the national energy system which has been promoted as the main tool for the development of the Colombian energy matrix. As with the ND Plan, the Law no. 1715 assigns task and responsibilities to the

different entities in the National Government in order to promote and develop renewable energy (RE) and EE in the country. However, the law still requires supporting regulatory degrees to put into force. Similarly, the coordination between the Government entities has not been defined. Therefore, its actions plans will only be implemented gradually.

In terms of quantitative targets, the programmes and plans proposed by the ND Plan, Law no. 1715 and other policies promoting have led to set up national GHG emission targets. However, there is currently no consistent system to measure how the actions individually implemented by each Ministry or entity actually contribute to the targets. In other words, there is no M&E system to determine how governmental programmes and policies contribute to climate change mitigation. The MinAmbiente is fully aware of this problem, and has urged all programmes currently in design and development, to include M&E provisions systems. An eventual integration of the contribution of all measures at national level is expected.

In addition to the regulatory challenges discussed above, in the case of industry there are also technical, institutional and financial barriers that need to be addressed to promote the adoption of EE measures. These barriers were described in the PIF, and summarized in section A.5. In the absence of the proposed project, the adoption of EE measures in industry would be hindered. Policies and programmes are being adopted by the Government at a gradual rather than accelerated pace; there is a limited coverage of technical training to certain regions; and there are limited financing options which are suitable to their specific needs. The detailed baseline scenarios for each component are as follows:

Baseline project

Standards and Technical Regulations

From a policy perspective, there is no mandatory Technical Regulation providing guidance on EE measure of either boilers or electric motors. The use of high efficiency motors is the promoted under the PROURE and target of the existing tax incentives; however these provisions have been insufficient to date. There is a new equipment labeling regulation that shall enter into force soon, the Technical Regulation of Labeling (RETIQ), which includes EE labeling requirements for motors. This Technical Regulation covers a range of consumer goods and industrial equipment, but has no provisions regarding steam generation equipment.

The Government initiatives on industrial boilers have been based on a number of studies identifying steam and hot water generation as the most fuel-consuming industrial activity. Therefore, all energy saving efforts should be focused on it. As described in section A.1 a new Technical Regulation for boilers was put under consideration in 2014, but has limitations for ensuring a measurable and/or acceptable boiler operation efficiency level. The challenges associated with introducing EE elements in the Technical Regulation for boilers manufacture and operation are:

- if targets for operation or minimum efficiency are included, it is necessary to ensure that the State has the technical and operative capacities to control and enforce such requirements;
- skepticism of relevant stakeholders in the development boiler regulations, due to a lengthy development process of the draft regulation; and
- technical awareness of industry to comply with regulation

In terms of voluntary instruments for IEE, the adoption of the technical standard (NTC-ISO 50001) has been piecemeal. The voluntary aspect of the standard has started to create a market for trainers, implementers and auditors. There are no quality standards defining the technical competencies that these services should include.

The national normalization organization, Colombian Technical Standards Institute (ICONTEC), has not only adopted the standard but also provides training courses on the general aspects of the standard as well as internal

auditor training courses, some of which are provided jointly with the national universities part of Energy Management diploma courses.

There are currently no accredited certification bodies who may certify the standard. The National Accreditation Body (ONAC) started in 2013 the process of obtaining international recognition to accredit management systems and it is expected to be completed in 2015.

There is a risk of proliferation of actors on ISO 50001 offering their service to the industrial entities, but not fulfilling their expectations, nor the main objective of this voluntary standard, which is to improve the energy performance of entities who implement it.

This situation might lead to limited impact on energy performance improvements and damage the good name of EnMS and other energy management and efficiency initiatives. In this context, National Normalization and Certification Institutions should introduce elements allowing the industry to access and identify quality ISO-50001 services with demonstrated success stories.

Capacity development on Energy Management Systems

The national programme to develop technical capacities was adopted in the period 2010-2013. The programme was centered in establishing an awareness raising, training and dissemination of EnMS and achieved substantial results during its four years of execution: It was conducted with the support of 15 national universities.

The first action in the programme was a gap analysis for the adoption of EnMS at national level and the identification of the capacity building needs. This analysis was the basis for designing a 'Trainers Programme', to be conducted by university professors. Participants in this course later became the faculty both an academic diploma course on 'Advance Energy Management', focused on implementing EnMS and the skills based 'Basic Energy Management' courses, to provide general understanding to support the adoption of EnMS. Both training schemes were implemented in five regions by the following universities, which formed a University Network:

Antioquia department: Pontific Bolivarian University (*Universidad Pontificia Bolivariana*)

Atlántico department: University of the Atlantic region (*Universidad del Atlántico*)

Bogota department: National University of Colombia (*Universidad Nacional de Colombia*)

Santander department: Industrial University of Santander (*Universidad Industrial de Santander*)

Valle del Cauca department: Autonomic University of the Occident (*Universidad Autónoma de Occidente*)

The existent capacity building programme on EnMS for professionals has been led by the Network which has focused on the largest cities; but it does not cover highly industrialized intermediate cities and regions. This has limited the coverage and access to technical training on EE. The CEMS programme was promoted by Universities which did reach out extensively to industries. During the period 2012-2013, this programme has trained 244 people at the diploma course level, out of which 155 were also trained as internal EnMS auditors. There was also a general understanding level training, of 60 class hours, which had 166 graduates. In addition, the National University of Colombia continued providing the diploma course in a custom-made version to utilities and selected enterprises, and trained 280 people. But, with only 12 industries adopting EnMS with the support of CEMS programme, the implementation of EnMS in industrial entities remains limited compared with the number of trained practitioners. Additionally, most of trained energy managers are concentrated in the regions where the training occurred. Due to the lack of industry awareness of the need for systematic energy management, the energy savings and EE projects developed by enterprises are very limited.

For the case of the Santander department while the Industrial University of Santander has participated in the CEMS programme, it has had limited results when compared to the other 4 Universities. The main results of the CEMS supported activities was imparting a 120-hours EnMS course in 2012 with 34 graduates and out of which 6

energy use assessment were conducted. Moreover, the CEMS programme director has reported that the diploma course has been discontinued.

Another aspect to consider is the number of enterprises certified under the ISO 50001 in Colombia and the manner in which the certifications were achieved pose a particular challenge. By the end of 2014, there were only five enterprises certified under ISO 50001 in Colombia. All the certifications were issued by international certifications bodies, since there are still no mutual recognition mechanisms ensuring the quality of certified EnMS. This results in substantial costs for enterprises seeking certification in ISO 50001.

To conclude, having a competent workforce of implementers and auditors would translate into the robust adoption of certified EnMS, reducing the risk of enterprises not achieving their energy saving targets and public recognition goals thus avoiding decision-makers disappointment and skepticism about EE projects.

System optimization technologies

The improved capacities on steam, motor and pumps system optimization are the result of the detailed energy characterization of the industrial sector conducted by UPME in 2013-2014. These studies show that 80% of fuel consumption is due to steam generation systems and that the average age of the boilers in operation in Colombia is over 30 years. In the case of electric motors, 80% of industrial electric use is from motors systems. The consideration of economic growth scenarios in the National Development Plan 2014-2018, shows the need for rationalization of power consumption and optimization in motor-driven applications.

In enterprises with high energy end-use equipment (motors, steam and pumps), the existing engineering solutions are normally limited to the equipment, and enterprises are normally unaware of benefits of optimization measures at the system level. Enterprises tend to invest in equipment modernization, taking into consideration initial capital costs, but seldom analyze the life cycle costs. Such was the case of a technical cooperation programme called *Promotion of Market Opportunities for Clean Energy (OPEN)* which was executed by the Chamber of Commerce of Bogota, and supported by the Multilateral Investment Fund (MIF) of the Inter-American Development Bank, between 2009 and 2012. The goal of this project was developing market opportunities for EE amongst consultants, engineering firms, technology providers, financial institutions and managers of middle size enterprises. The project focused on the concept of Energy Service Companies (ESCO) models and conventional energy audits. The main achievement was that 180 SMEs from 13 industrial sectors implemented projects in Best Operational Practices for Energy Efficiency, resulting in average of 8% improvement in EE.

In the current academic curricula of the EnMS University courses under the CEMS programmes there is a general introduction to energy end-users theory and best practices, to satisfy a non-detailed energy assessment. Hence, the graduates from these programmes are unable to conduct thorough system assessment and propose any operational and technical improvements to enterprises. The CEMS lead team recognizes that this skill is generally lacking both at the academic and industry levels.

The main barriers for adopting EE measures in systems are related to a lack of awareness of system approaches, and a common concern that any boiler upgrades or steam system modification implies a complete operational shutdown. There is a need to develop capacities on systems optimization due to lack of awareness and technical skills to conduct systems assessments. The lack of mandatory regulations for energy end-users is also an obstacle to motivate industries to adopt such measures.

Financial mechanism for investment in IEE

The development of financial schemes and products for EE in Colombia has so far only served a limited number of enterprises. The existing mechanisms include fiscal incentives for EE promotion, consisting of the elimination or reduction of some taxes; and some Government sponsored credit lines focused on the promoting of Sustainable Development.

As mentioned above the national fiscal policy (law no. 223 from 1995 and administrative amendments) established a mechanism to provide fiscal incentives, including VAT elimination and income tax reduction, for equipment and elements for environmental monitoring and control, focusing on noxious pollutants to the environment. The regulatory decrees of this law state that such incentives could also be given to projects or programmes which reduce energy consumption or promote EE; provided that these incentives would be used to support measures required to meet environmental targets set jointly by the Ministries of Environment and Sustainable Development and Ministry of Mines and Energy. In 2012 the two Ministries have progressed in setting joint targets to be met by 2015 (joint resolution no. 168 of 2012) for EE in industry and transport sector, as well as for RE, the so-called non-conventional energy sources (NCES)⁴ in Colombia.

During 2013 only 29 projects have been submitted and these requests represents economic benefits for the enterprises in the order of U\$S 40 million (80,000 million COP). Yet, the use of the incentives remains very limited.

Banks have designed and offered financing services under green credit lines, which in some cases receive Government of Multilateral Institutions funding. Such is the case of successful credit lines have been created for EE in other economic sectors. This was the result of detailed assessment of the needs of those sectors. For example, Bancoldex has established a dedicated credit line in 2014 for EE in the hospitals and hotel sectors. Projects under this credit line undergo a very thorough technical feasibility evaluation as a mechanism to reduce the risk in the investment, but increase the transactional costs⁵. This initiative is being supported by the Climate Investment Funds programme and the Inter-American Development Bank.

Bancoldex also offers four credit lines to finance projects with environmental benefits, two of which are specifically aimed at EE and RE projects. These “credit lines for sustainable development” are for the projects’ financing and for the design, construction, installation and the operation of control systems and monitoring of the production processes, and the “credit line for EE and RE” is meant to optimize the consumption of electrical or thermal energy, or to improve processes and increase business productivity . These credit lines are more conventional in their design; require risk assessments which are similar to any industrial upgrading loan. These credit lines have resources of 90 billion COP (38 million \$) available.

Another national financing institution, Findeter, has also succeeded in establishing an EE credit line for lighting and RE. While the aim of this credit line is to promote modernization of lighting systems, it also contemplates “all projects that contribute to EE and GHG emission reductions”. These credit lines have resources of 100 billion COP (42.5 million \$) available.

In terms of awareness raising on target financing for EE, a group of 11 financial institutions in Colombia have subscribed in 2012 a “Green Protocol” with the national government. The aim of this voluntary agreement is to integrate sustainable development parties in their business as well as their products. The activities undertaken by the subscribing banks include the creation of credit lines promoting sustainable development measures; promote the sustainable use of resources in their internal processes and include social and environmental criterion for their credit risk assessment. Findeter is the chair of the internal capacity building efforts within the Green Protocol.

The existing initiatives have not targeted industry needs towards EE and have not managed to catalyze investment in this sector. Under the fiscal incentive scheme, which has been operational for over two years, only three projects for electric motors upgrading have been approved. There is lack of awareness on how to apply to government incentives.

In general, the financing services for EE projects are offered under internal bank policies on product structuring and risk assessment, considering only capital market regulations. As a result, these products have not

⁴ National law on rational use of energy (n 697 from 2001) established that non-conventional energy sources (NCES) for Colombia are: solar, wind, biomass, small hydro power (< 10 MW), geothermal, marine and nuclear

⁵ Current assessment are conducted by the National Normalization Organization (ICONTEC)

distinguished themselves from conventional industrial upgrading or environmental protection credit lines; and have failed to attract enterprises. Hence, it is difficult to assess the real impact of existing credit lines on EE investment. There is limited knowledge in the national banks of the specific needs and challenges of EE projects in industry.

A.5 Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by the project

The proposed project shall strengthen the technical and financial capacities of relevant stakeholders by enabling them to scale up EE measures which have been piloted by nationally driven programmes, and will address the barriers faced by implementing the following measures:

Project Component - outcomes	Barriers	How the proposed project addresses these barriers (Ref. to section B: Project Framework)
Standards and Technical Regulations	<p>Efforts on EE measures adoption have been initiated by the Government, but support mechanisms are required to strengthen the programmes.</p> <p>Regulation is not complete. For example, technical regulation on industrial equipment does not establish a quantitative baseline on EE.</p> <p>No mechanisms to ensure the competency of the workforce promoting EE measures (implementers and auditors).</p> <p>Lack of mechanisms to effectively monitor and verify results achieved by project adopted at enterprise level, resulting in limited data for policy analysis.</p>	<p>2.3 Scale up of the CEMS to selected manufacturing regions and industrial subsectors</p> <p>1.1 Revision of the legal EE framework, focused on technical regulations for labelling of boilers</p> <p>1.3 National energy implementer and energy auditor certification schemes are defined, and institutions which can assess conformity are identified</p> <p>1.4 Piloting of the personnel certification programme is made, focusing on trainees from the CEMS</p> <p>1.5 Design of a M&E scheme for EE measures</p> <p>3.5 M&E systems are applied to selected enterprises</p>
Capacity development on Energy Management Systems	<p>EE is not a core interest for most industries and company strategies tend to focus on output growth rather than cost management. Therefore, the need to train the companies' managers is clear.</p> <p>Limited practical capacity of trained implementers, as training is academic focused rather than practical. Limited geographical outreach, focused only on 5 regions.</p> <p>EnMS implemented in a limited number of industrial entities.</p>	<p>2.1 A dedicated training on energy management for 200 enterprise managers and financial managers</p> <p>2.2 System optimization training and web-based tools are developed and 50 EE professionals received EnMS implementer level training</p> <p>2.5 Energy management plans to be implemented in at least 150 entities are designed</p>

Project Component - outcomes	Barriers	How the proposed project addresses these barriers (Ref. to section B: Project Framework)
		<p>2.4 The awareness of 500 industrial entities of new regions/sectors on comprehensive EnMS is raised</p> <p>3.3 Awareness level training on systems optimization offered by trained local experts to 400 industry representatives, including 75 supply-chain partners and the 200 entities from Component 2</p>
Technical capacity development on Systems Optimization	<p>Facility engineers tend to focus on components, not on systems. When processes and equipment change over time, inefficiencies in term of energy use compound and reoccur.</p> <p>There is no information about the state or the art; available technology and good practices alternatives; performance baselines and financing schemes/options.</p> <p>The energy consumption monitoring, reporting and analysis capacities required to encourage enterprises to develop EnMS and to implement system optimization projects are very limited.</p>	<p>3.2 75 EE professionals received implementer level system optimization training (25 for each type of system: motors, steam and pumps) in each region</p> <p>3.4 At least 45 in-depth energy system evaluations are completed in industrial facilities (15 for each type of system: motors, steam and pumps)</p> <p>4.3 A portfolio of investment projects is created with EE projects identified in the activities for each financing scheme designed</p>
Financing mechanisms	<p>The government incentives to encourage EE have had a limited impact. The private sector financing schemes offered by both banks and second tier institutions supported by own resources and international development banks (IADB, IFC) have not been attractive to enterprises.</p> <p>Bank credit analysts are not required to assess benefits from EE projects when evaluating them for green credit lines</p>	<p>4.1 The existing national financing scheme for EE measures is evaluated</p> <p>4.2 At least 2 financing schemes for the Colombian industrial entities are redesigned or designed</p>

Modifications of the project scope in comparison to the PIF

The project scope has remained largely the same as at the PIF stage. Adjustments were proposed to each component to better suit the needs of the analysis performed during the PPG stage.

The main adjustments include:

- The first component changed its focus from the development of mandatory Technical Regulations to instruments which can be more easily used and adopted by government and enterprise alike. Therefore, it was decided to develop a technical manual to be used as a voluntary guide to support boiler selection by boiler operators who will be subject to the Technical Regulation.
- During the PPG phase project dissemination workshops were held, to engage stakeholders and potential beneficiaries in all regions selected in the PIF for the implementation of the EnMS capacity building component. Having characterized the regions, their industrial subsectors and progress of EnMS programs, it has been observed that:

- The departments of Santander and North of Santander, while geographically close, operate as independent regions. Hence, for the detailed design it is considered that 4 rather than 3 regions are being covered.
- All regions manifested interest in actively participating in the program and validated the design
- A differentiated training for equipment vendors and awareness raising for enterprises on systems optimization measures has been explicitly listed as output 3.3.
- A difference was established between Monitoring and Verification (M&V) actions at enterprise level in component 3, and Monitoring and Evaluation (M&E) for programmes and policies in component 1.
- The output related to 45 in depth energy system assessments in industrial entities (4.1 from PIF document) is now in component 3. This is because the assessments conducted by the trainees from the system optimization training programme are an integral part of the training. Also, because component 4 is strictly focused on financial aspects. The financing and cofinancing has been modified to reflect this change.
- The budget for component 3 has been shifted to reflect the addition of output related to 45 in depth energy system assessments.
- Revision and redesign of the financial component, based on discussions with key counterparts in this sector:
 - There is recognition that the basis to develop credit lines and financing products from national banks has been the result of the detailed opportunities assessment of those sectors. Also, the needs related to project assessment capacities of the bank professionals were identified.
 - Both government and FIs recognized that credit officers lack the capacity to properly assess EE projects. For the case of industry, in which multiple EE technologies could be adopted, this hurdle would be significant. Therefore it was proposed to develop simple tools for the rapid assessment of projects to assist credit officers.
- The detailed information obtained from the industrials sector assessments led by UPME have been analyzed and used as the main data source for GEBs estimation. This data was feed into the GEF EE calculation tool. The assumptions made were validated both with UPME staff in charge of energy data modelling, as well as with academic staff from the EE network.
- A gender analysis was conducted taking into consideration the UNIDO guidelines for gender mainstreaming in energy and climate change projects. The results of the analysis are summarized in Annex J.

Propose project activities

The proposed project has five components which must produce specific outcomes as described below:

Component 1 Standards and Technical Regulations

The first component aims to strengthen targeted elements of the existent national legal regulatory framework. It also strengthens the institutional capacity of key government stakeholders who have a role in the adoption of voluntary standards, namely the bodies in the quality infrastructure system. The detailed outcomes are outlined below:

First, activities in this component aim to provide technical instruments for the appropriate use of Technical Regulations -in force and/or in preparation- for boilers. It also contemplates the dissemination of these instruments amongst the enterprises and manufacturer that would subject of the Technical Regulation.

Second, the activities aim to support the energy management quality infrastructure subsystem, by defining a personnel certification programme for technical specialist in EnMS implementation. To do so a competence profile for technical specialists will be analyzed, based on best international practice and will be translated into a national standard. This activity will be carried out by the Colombian Technical Standards Institute (ICONTEC). Additionally, and in order to build trust in industries seeking certification, the accreditation mechanism for certifying institutions will be established with the National Accreditation Body of Colombia (ONAC). Some national institutions that could become the first certification bodies for the personnel accreditation schemes have been engaged during the preparatory phase. These organizations are part of ICONTEC which is devoted to certification, and the Centre for Research and Technology Development (*Centro de Investigación y Desarrollo Tecnológico - CIDET*), which is the national institution mandated with the quality assurance for the electric sector, and is also a management system certification body.

Third, the certification scheme for technical specialists will be piloted amongst two different groups. On one hand the expectation is that at least 5-10% of the graduates from the national EnMS diplomas courses get certified (20 people) and on the other hand that 25-30 % of the trained experts from component 2 also get certified (12-15 people). Once the certification pilot methodology and results are evaluated and reviewed, a definitive functional certification scheme should be in place for a periodic round of certification of future specialists.

Finally, this component shall provide methodologies to assess the contribution of the different policies measures that are being adopted by the national targets. These methods shall be applied by UPME staff, since UPME is mandated to oversee the implementation of the PROURE under the resolution 168 of 212.

The detailed activities for the component 1 are outlined in the table below:

Results	Expected Outputs	Activities
Standards and Technical Regulations	1.1 Revision of the legal EE framework, focused on technical regulations for labeling of boilers	1.1.1 Revision of Technical Regulation of Boiler final version, to be issued by the Ministry of Mines and Energy 1.1.2 Development of a technical guide on boiler selection with EE considerations
	1.2 Awareness raising and dissemination of technical regulation amongst users	1.2.1 Technical regulation and guide users (enterprise, certification bodies, vendors) receive awareness raising training
	1.3 National energy implementer and energy auditor certification schemes are defined, and institutions which can assess conformity are identified	1.3.1 Identification of entities with capacities to certifies personnel competences for professionals 1.3.2 Definition of characteristics, requirements and basics roles for EnMS implementers and auditors based on best international practices (job task analysis). 1.3.3 An implementer certification exam is designed

Results	Expected Outputs	Activities
	1.4 Piloting of the personnel certification programme is made, focusing on trainees from the "Comprehensive Energy Management System" (CEMS)	1.4.1 Dissemination of certification scheme amongst graduates from Energy Management Diploma course with support of RECIEE (network of universities) 1.4.2 Consolidation and establishment of EnMS accreditation schemes
	1.5 Design of a Monitoring and Evaluation (M&E) scheme for EE measures	1.5.1 Establishment of energy consumption baseline, indicators and performance targets for each PROURE EE action line 1.5.2 Design of a monitoring mechanism for the executed actions and an assessment method for results, based on PROURE targets

Component 2: Scale up the program "Comprehensive Energy Management System" (CEMS) to national level

The second component seeks to strengthen the existing University programmes on EnMS, homogenizing the curricula and methodology offered. An objective of that revision of the programme is to progress practical training at enterprise facility level, which will require the establishment of stronger links between the existing government-academia structures under the University Network with enterprises.

This component takes advantage of the existing academic structure and programmes on EE, and strengthens the capacities of universities that have developed pilot programmes and academic activities in cooperation with RECIEE and Colciencias. The universities from the network that currently offer the courses for graduate students available in the national market are concentrated in the main cities (Bogota, Barranquilla, and Cali). The network will be strengthened in two ways: 1) developing a single shared training programme and 2) sharing the lessons learned by the universities participating in the CEMS with other universities from the new regions.

The main objective of this component is to provide implementer level training in the regions identified in the PIF, namely Boyacá-Cundinamarca, Risaralda-Caldas, Santander and North of Santander regions. The training courses will be offered by local universities, to local enterprises, facilitating access to a wider number of beneficiaries. 50 professionals will receive EnMS implementer level training, resulting in the development of 150 EnMS implementation plans for 150 enterprises from the regions covered by the project. As a consequence of adopting EnMS, the enterprises contribution is to adopt tangible measures on their management system which translate in direct changes in the operation of their facilities, resulting in improved energy performance. The contribution of enterprise is typically of 300-500 man hours for medium to large enterprises.

The training shall be homogenized at national level with the support of international experts. The training programme materials will be localized to conditions within Colombia. Trainings will be conducted by national professors who are currently conducting the diploma courses, and new trainers from the selected universities in the four regions.

The sustainability of training programmes to be provided in this project shall be achieved by ensuring that at least one University on each of the four new regions is fully equipped to continue providing EnMS diploma course level training courses; and in addition to make these Universities become active members of the national EE Network. In addition, all trained experts shall be invited to get certified under the scheme to be created in component 1.

For the Universities which already offer this programme in their academic programme, the goal is to provide a homogenous, improved training programme which is “hands-on” and enables a better outreach from academia to enterprise.

Trainees for the expert level programme shall be selected under criteria established in the Training Programme Framework, which involves several steps: the candidates are invited to apply; then a pool of candidates is preselected and invited to the user training. During the users training the candidates are assessed by the trainers and sit for a written assessment. A weighted criterion assessment is then made to select the most suitable applicants.

The enterprises in which energy management plans will be designed will be invited to participate in both the awareness raising and user-level trainings, with agreement that trainees can undertake the practical activities of their training within enterprises facilities. Enterprise selection will be made based on relevance within their industrial sub-sector (focusing on high energy consuming sectors); the potential to become cases studies; and willingness to invest in EE measures. During the design phase the local Chambers of Commerce, Industry Associations and local Universities in the four regions have been sensitized about their role in the execution of the component.

The detailed activities are outlined in the table below:

Results	Expected Outputs	Activities
Capacity development on Energy Management Systems	2.1 A dedicated training on energy management for 200 enterprise managers and financial managers	2.1.1 Establishment of a shared diploma programme for the universities of the participating regions 2.1.2 Eight seminars for 25 persons (2 for each region) are held. - 1/2 day workshop
	2.2 System optimization training and web- based tools are developed and 50 EE professionals received EnMS implementer level training	2.2.1 Development of materials (guide, tools and software) 2.2.2 Establishment of selection criteria to select 50 national experts. Identification of experts 2.2.3 Two groups of 25 experts receive implementer level training 2.2.4 Promotion of national certification mechanism between the trained specialists
	2.3 Scale up of the CEMS to selected manufacturing regions and industrial subsectors	2.3.1 Establishment of support systems between the universities participating in CEMS network and universities from the new regions, to ensure that they have the required capacities (<i>train the trainers</i>)
	2.4 The awareness of 500 industrial entities of new regions/sectors on comprehensive EnMS is raised	2.4.1 Trainers are identified and receive awareness training 2.4.2 Twenty 2-day seminars (<i>user training</i>) for 25 persons (2 for each region and in other locations) are held

Results	Expected Outputs	Activities
	2.5 At least 150 entities implement and develop energy management plans, leading to improved energy performance.	2.5.1 Trained experts from output 2.2 working in 150 industrial entities on designing an energy management plan

Component 3: Transfer of system optimization technologies

The third component seeks to build technical capacities on systems optimization measures for motors, pumps and steam systems. The University diploma programmes offer just a general introduction to industrial equipment and there are no national capacities on this approach. Therefore, the knowledge transfer on system optimization activities from this component will have the support of the project's international experts.

The objective is to train 75 EE professionals on assessment and system optimization training for energy end-uses (25 for each type of system: motors, pumps and steam). This component will also have a strong practical orientation, an important part of the training consists on in-depth energy systems assessments. As a part of the training and under the supervision of international and national experts, trainees are expected to develop system optimization plans in 45 industrial entities, 15 for each system (motors, pumps and steam).

Enterprise will contribute by providing 50-100 man hours of their staff time to conduct thorough assessment of their energy consuming systems to identify system optimization measures. These include low cost capital investment which reduce energy use, such as: redesigning of steam and condensate lines to reduce pressure losses; use of vapour traps; thermal insulation of steam pipes and equipment; steam generation repowering; waste heat recovery; replacement of oversized motors; automation of ventilation systems; implementation of variable speed drivers or soft starters; implementation of harmonic filters and power factor correction

The training shall be designed with the support of international experts. The training programme materials will be localized to conditions within Colombia. Trainings will be conducted jointly by national and international trainers; a licensing fee to the training is included in the UNIDO co-financing contributions to the project (see Annex F).

The sustainability of these training programmes will be based on identifying national institutions that can continue providing the training programmes. The National Universities conducting EnMS diploma training and the National Vocational Training Institute (*Servicio Nacional de Aprendizaje, SENA*) are the most likely candidates. Participants of the experts training programme shall have the capacities to impart the awareness raising training.

Trainees for the expert level programme shall be selected under criteria established in the Training Programme Framework, which involves the same steps as those described for EnMS candidates. The enterprises that will undertake activity 3.4.2 will be selected during the development of the steam, pumps and motors systems optimization training, by inviting interested enterprises to participate in both the trainings, with agreement that trainees can undertake the practical activities of their training within enterprises facilities.

Similar to the case of the EnMS training, the enterprise selection will be made based on relevance within their industrial sub-sector (focusing on high energy consuming sectors); the potential to become cases studies; and willingness to advance their in depth energy assessment into improvements plans. As a result, industries will be able to report the improvement on energy performance systematically.

Finally a methodology for collecting information form the enterprise which conducts in depth assessment will be devised, so that each enterprise can establish systematic monitoring of their key energy performance indicators.

This scheme will contemplate a reporting system across enterprises that can then be fed into a national reporting database. Such database on specific energy consumption by system in industrial process and their EE gains are key data that Government institutions, such as UPME will be able to use evaluate not only energy consumption but the efficacy of policies directed at enterprises. In other words, the data monitoring and reporting at enterprise level in activity 3.5.2 should serve as a data source for the policy level monitoring and evaluation in activity 1.5.2.

The detailed activities are outlined in the table below:

Results	Expected Outputs	Activities
Technical capacity development on Systems Optimization	3.1 System optimization training and web-based tools are developed	3.1.1 Development of materials (guide, tools and software)
	3.2 75 EE professionals received implementer level energy end-use system optimization training (25 for each type of system: motors, steam and pumps)	3.2.1 Establishment of selection criteria to select 75 national experts. Identification of facilities for practical demonstration 3.2.2 Three groups of 25 experts (motors, steam, pumps) receive detailed training
	3.3 Awareness level training on systems optimization offered by trained local experts to 400 industry representatives, including 75 supply-chain partners and the 200 entities from Component 2	3.3.1 Awareness level training offered by trained local experts to 325 industry representatives, including 200 entities from Component 2 3.3.2 Specific awareness raising for 75 equipment vendors (25 per system)
	3.4 At least 45 in-depth energy system assessments are completed in manufacturing facilities to identify system optimization measures (15 for each type of system: motors, steam and pumps)	3.4.1 Development of a list of candidate plants for assessments (first candidates are enterprises with an implemented EnMS) 3.4.2 The trainees experts complete 45 in-depth energy system assessments
	3.5 M&V systems are applied to selected enterprises	3.5.1 Collection of detailed information on outcomes achieved by industries (monitoring) 3.5.2 Use of schemes for report outcomes indicators designed in component 1

Component 4: Promotion of financial mechanism for investment promotion at enterprise level

The fourth component supports the creation of dedicated financing schemes for EE in industry, because there are significant resources available for sustainable development financing from national banks; but there are no specific EE credit lines for industry. This will be achieved by investigating the specific needs of industrial subsector and tailoring financial products to those needs.

First, the promising industrial subsectors will be selected to be the object of a market research seeking to identify financing needs and business opportunities. The selection of three subsectors will be based from the analysis of the beneficiary enterprises from activities 2.5.1(EnMS plans in 150 enterprises) and 3.4.2 (in depth systems assessment in 45 enterprises). The aim of the market analysis is to provide financial institutions with an analytical basis to develop dedicated financing products.

Second, the component will aim to build capacities on the assessment of EE projects amongst banks, by promoting initiatives such as “Green Protocol” which is a voluntary agreement between the National Government and a group of public and private banks promoting sustainable practices in their operations. One of the measures to be promoted amongst the subscribers Financial Institutions to the Green Protocol is a simple tool for the evaluation of sustainable development aspect of EE projects. Also, strategies for the development of business model for EE in industry will be encouraged. This will be achieved by dedicated awareness raising to 30 senior officials from Financial Institutions.

Third, EE measures identified in component 3 shall be translated into improvement plans at facility level. In this process a portfolio of investment projects will be created based on the beneficiary enterprises from activities 2.5.1(EnMS plans in 150 enterprises) and 3.4.2 (in depth systems assessment in 45 enterprises) for the in-depth assessment. Enterprises will be invited to put forward their interest to participate in the development of bankable business plan. Each project must include project progress, efficiency and emission reduction potential, investment level and indicators of the investment return.

Finally, business round tables will be organized to present the industries that have investment plans with the available financing schemes and tax incentives systems. The aim is to support the access to credit of enterprises that identified technically sound EE projects. Credit lines to the tune of 80 billion COP (38 million \$) are readily available to enterprises, as identified in the Bancoldex cofinancing letter presented in Annex I.

The activities in component 4 include:

Results	Expected Outputs	Activities
Financing mechanisms A national financing scheme for the implementation of EE measures in the industrial sector is assessed and financing institutions are strengthened to assess IEE projects	4.1 The existing national financing scheme for EE measures are evaluated	4.1.1 Selection of the 3 more promising industrial subsectors (<i>winning sectors</i>) from projects in component 3 4.1.2 Development of feasibility studies to invest in EE project in 3 industrial subsectors
	4.2 At least 2 financing schemes for the Colombian industrial entities are redesigned, , strengthening the tools used by the investment banks	4.2.1 Design instruments to rapid assessment of projects encompassing financial, environmental and social aspects 4.2.2. The institutional development of the bank sector is promoted establishing a “ <i>Sustainable Energy Desk</i> ” model with capacity to develop dedicated financing products for investments related to PROURE action lines, and 30 senior officials awareness is raised
	4.3 A portfolio of investment projects is created with EE projects identified in in the activities of outputs 2.5 and 3.4 for each financing scheme designed	4.3.1 Inventory of investment opportunities identified by the in-depth assessments from component 3 4.3.2 Bankable business plans are prepared
	4.4 Management for implementing the designed financing schemes in investments projects identified in the portfolio	4.4.1 Organization of business round tables where the financial institutions and the proposing industrial entities assess the portfolio in order to materialize investments

Component 5: Monitoring and Evaluation

Finally, the fifth component is centered in establishing a solid Monitoring and Evaluation (M&E) mechanism to ensure the achievement of the project objectives.

Results	Expected Outputs	Activities
Monitoring and Evaluation (M&E)	5.1 The project M&E plan is designed and executed	5.1.1 Inception workshop (IW) is conducted 5.1.2 Design of monitoring plan and tools for data collection and recording 5.1.3 Periodic progress reports and monitoring of project impact indicators (as per LogFrame) 5.1.4 Measurement GEF Tracking Tool selected indicators
	5.2 Final project evaluation is conducted	5.2.1 Internal Mid-term Review (MTR) 5.2.2 Independent terminal project evaluation
	5.3 As part of the terminal evaluation, follow-up actions recommendation are determined for long term project sustainability	5.3.1 Follow-up actions recommendations are considered by the national counterparts to ensure long term project sustainability

Global Environmental Benefits

The proposed project will generate the Global Environmental Benefits (GEBs) presented in the table below:

Savings for All Project Components	2015-2017 (direct)	2018-2027 (direct post project)	2018-2027 (indirect bottom up)	2018-2027 (indirect top down)
Electricity Savings (MWh)	47,920	320,347		
Fuel Savings (GJ)	724,027	4,844,986		
Total Energy Savings (GJ)	896,537	5,998,236		
GHG Emission Savings (tCO ₂)	69,750	466,719	2,100,236	2,099,491

The primary data for the calculation of the GEBs was the in-depth assessments on energy consumption and saving potential conducted by UPME in 2013-2014. The study was carried out by national consultants and consisted of research, surveys and modelling covering 9527 industrial entities divided in 21 subsectors, including energy intensive manufacturing groups. Also a small data set of energy use was gathered from potential beneficiaries in the four regions in which component 2 will be implemented. The data from the detailed assessments was contrasted to small data set and is consistent

The data sources used in for the calculation were compared with the sources used to calculate the GEBs at PIF stage (macroeconomic method). The main conclusion is that there are discrepancies in the energy savings potential between the data for the PIF and the new data.

The information used at PIF stage was collected to assess the results of a national programme and was limited to a restricted number of enterprises (only 200). On the contrary, the data collected for the 2013-2014 assessments are the result of a systematic method aiming to identify actual potentials.

The result of these data discrepancies is that the direct emissions reduction are more modest than at the PIF stage, however, the CEO EF estimation is more accurate, both because of the data used and the level of analysis used in calculations.

Detailed information on the assumptions and calculation methods are presented in Annex E. The assumptions were made using the GEF manual and tool to calculate reductions in EE projects.

A.6 Risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and measures that address these risks

The main risks to the effective implementation of the proposed GEF project are described in the following table:

Risk	Level	Mitigation
Demonstration projects are delayed, limiting the opportunity to disseminate success stories and develop case studies.	Low	Factories selected as demonstration sites for the expert-level training will be carefully screened for management support for implementation of the resulting recommendations. These factories are anticipated to provide the initial case studies and thus serve as examples for other factories. The costs of operational improvements resulting from the implementation of an energy management plan are typically small. Likewise, system optimization projects typically have very attractive paybacks and require modest investments. Both types of improvements frequently have other benefits – such as reduced maintenance or less product waste. The opportunity to approach both energy management and system optimization incrementally with early small successes creates highly favorable conditions for implementation.
No immediate demand of services for trained experts.	Medium	The integrated approach adopted by the project is expected to mitigate this risk by combining expert training with factory training designed to create interest in the services that the new national experts will provide. Also, the practical skills resulting from the expert training will meet a market need by assisting industrial entities to prepare for ISO 50001 compliance and by identifying immediate opportunities to improve EE in systems, thus increasing the productivity of existing system assets.
Lack of coordination between various partners involved in other EE programmes.	Low	Proper coordination will be sought through the Project Steering Committee, and ad-hoc working groups per sector or theme can be set up as needed, bringing in other partners and beneficiaries.
Only a few enterprises make use of ISO 50001.	Medium	There will be competitive pressures outside of the project to conform to ISO 50001 in order to participate in some attractive export markets. By creating a cadre of experts to assist Colombian industry in achieving this goal, the project offers participants a competitive advantage.
Incentive and financial support systems are insufficient, especially for SMEs.	Low	Financial institutions will be encouraged to learn more about IEE savings potential; and industries will be made aware of the financing opportunities through the creation of a portfolio in output. 4.3.

Risk	Level	Mitigation
Vulnerability to climate events.	Low	The type of interventions to be undertaken in this project (demonstration and diffusion measures) has negligible vulnerability to climatic events.
Lack of adoption of safety regulations for industrial boilers	Low	The regulation is centered on safety aspects, the output of this project focuses on developing support guidelines for policymakers and industry to progress towards the establishment of policy instruments for energy efficiency.
<p>Social and Gender Risk</p> <p>Risk of resistance against, or lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality.</p> <p>Low participation rates of suitable female candidates due to lack of interest, inadequate project activity or missing qualified female population within engineering sector.</p>	Low	<p>Colombia, while having a number of significant gender issues, is a pro-gender equality society.</p> <p>This Project will pursue thorough and gender responsive communication and ensure stakeholder involvement at all levels, with special regard to involving women and men, as well as CSOs and NGOs promoting GEEW, and a gender expert. This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance, and maximize the potential contribution of the project to improving gender equality in the energy field.</p>

A.7 Coordination with other relevant GEF financed initiatives

In addition to the government led initiatives and the GEF funded project focused on EE described in the PIF, the proposed project has taken into consideration during its design the exiting or completed projects in the Colombia/GEF portfolio in order to avoid duplication and to identify potential synergies for collaboration. Such initiatives include:

GEF initiatives

Energy Efficiency Standards and Labels in Colombia (S&L Colombia)

This programme implemented by UPME and UNDP and funded by the GEF (ID3930) supports the Technical Regulation of Labeling (RETIQ) Project. The RETIQ objective is to develop a mandatory regulation on EE labeling of energy end-uses to be sold at the national market, concerning particularly appliances and electric motors. The UMPE-UNDP programme seeks to assess and strengthen the capacities of the national quality subsystem to establish national metrology services enabling to collect the data required for developing EE indicators for the labeled equipment/technologies. The RETIQ has a component of training and awareness-building seeking to train large retail stores vendors with direct contact with consumers on the concepts of EE, enabling them to disseminate the message.

UPME-labeling programme has a component of capacity development for public and private stakeholders. It focuses on training public authorities on policies development and implementation as well as on normalization and labeling programmes. Customs inspectors receive training to be able to control compliance with technical requirements. This is an important previous task to prepare the institutional field for the IEE project purpose: to strengthen and promote the initiative on Technical Regulation of Boilers.

UPME-labeling programme has a second component seeking to analyze the changes on appliances and electric motors market. This aspect should be considered when training the specialist in motor systems optimization (component 3) and ideally when specifying projects to be complete in component 4.

UPME-labeling programme has also a component seeking to strength the legal and regulatory framework concerning the sale and use of energy equipment. Although this effort focuses on technologies other than boilers, the awareness activities involving staff and equipment manufacturers participating in the an Intersectoral Commission for the Rational and Efficient Use of Energy (CIURE) are a good preparation to similar discussions on boilers.

Finally, the UPME-labeling programme fourth component involves awareness-building in consumers, focusing on retail trade and promoting dedicated incentives for consumers. This component includes information activities focusing on available technologies and financing mechanisms to purchase the technologies. The outcomes from these efforts will produce lessons to be considered when developing component 4 of the proposed project.

Improving Energy Efficiency in Buildings in Colombia through Synergies between Environmental Conventions

This project was implemented by UNDP and UPME with GEF resources (GEF ID 3479) since 2009. Many of its elements are similar to those in the proposed project, but this project focuses on buildings. The project objectives include: "Promotion of energy efficiency in buildings removing institutional, legal and regulatory barriers. Development of the capacities and technical skills required to spread the adoption of energy efficiency in buildings".

This effort produced the establishment of certification agencies and bodies to assess conformity of personnel certifications and energy service companies (ESCO) as well as regulatory instruments such as dedicated standards for buildings. It also established a technological change, in synergy with the Multilateral Fund for the Implementation of the Montreal Protocol (MFMP) identifying 13 plants with chillers to be replaced in order to reduce the use and effects of refrigeration based on CFCs. The project focused its efforts in the building sector and therefore not evident overlap with UPME-UNIDO project is anticipated.

Industrial Energy Efficiency in Ecuador

This project is being implemented by the Ministry of Electricity and Renewable Energy of Ecuador and UNIDO a with GEF resources (GEF ID 4147) since 2010. The project design has many similarities both of them promote capacity building for EnMS and systems optimization. The Ecuador projects serves as a model for localization of the training programme in Spanish language.

The synergies and lessons learnt from the Ecuador project were discussed with the proposed project design team in a bilateral meeting in Quito in June 2014. During the meeting it was proposed that Ecuadorian universities could join the EE University network under operation in Colombia. Lessons from the execution of activities at enterprise level were discussed with UPME and are reflected in the proposed project design.

Other relevant initiatives

Mechanism for Voluntary Mitigation of GHG Emissions in Colombia

This project aims to formulate and establish the technological and institutional platform basis for a verified emission reductions (VERs) market mechanism and to facilitate efforts of voluntary mitigation of GHG emissions in Colombia. This project is considered as a potential mechanism to promote investment in EE projects, but since its scope differs significantly from the proposed project, not evident overlap is anticipated.

NMI-UNIDO Quality Infrastructure Programme financed by SECO

In October 2014, started the Quality programme for the cosmetics sector in Colombia executed by UNIDO. This programme is an initiative to support Colombian integration in a multilateral trade system. The objective will be achieved by strengthening Colombia's national quality infrastructure and by increasing national capacity (using as demonstration the cosmetics subsector) and compliance with international and private quality and sustainability standards. The counterpart for the NMI-UNIDO includes important stakeholders such as the Productive

Transformation Programme (PTP), Ministry of Trade, Industry & Tourism (MinCIT), National Department of Planning (NDP), National Metrology Institute (NMI), National Accreditation Body (ONAC) and the Superintendence of Industry and Commerce (SIC). The programme is a contribution to improve the cosmetics sector until it is mature and fully prepared to access the international markets through an improved capacity to assess conformity and compliance with international standards. Also, the programme will help to develop a better institutional environment able to certified private initiatives.

The proposed IEE-Colombia project may benefit of the experience of the NMI-UNIDO programme in strengthening the capacities on standards assessment, conformity and compliance, adapting the quality infrastructures activities completed in the cosmetics sector to the wider objective of strengthening the services for implementing and assessing ISO-50001 compliance. Similarly as the NMI-UNIDO programme, the proposed IEE-Colombia project will specifically coordinate its efforts with PTP, MinCIT and ONAC in order to achieve the objectives from component 1. The chances of assimilate and incorporate the lessons learned while completing the NMI-UNIDO programme in the proposed IEE-Colombia project are bigger because both were executed by UNIDO.

CTCN request: Monitoring and evaluation (M&E) of national promotion for energy efficiency (EE) against national targets (2014-004 COL-02)

In 2014, UPME asked the Climate Technology Centre and Network (CTCN) to evaluate and assess the effectiveness of the different tax tools promoting EE in Colombia (those in place and those who have been suggested). The analysis will allow to determine to what extent the incentives contribute to the PROURE Indicative Action Plan 2010-2015 and to learn some lessons about how to plan new EE incentives in the future. The aid will consist in a potential 6-months "quick response project".

The aid main outcome will be (i) to evaluate the performance and efficiency of the financial incentives from the Resolution 186/2012 implemented in the industrial and transport sectors; (ii) to evaluate whether or not other actions lines and sectors (services and buildings) should be included in the programme and (iii) to evaluate whether it would be wise to scale-up the instruments for EE promotion.

The results from the analysis will allow UPME to review tax incentives for EE promotion. The project will have synergies with the proposed project because some of the new incentives that might be considered have been already taken into account in the proposed project. This is the case of the national promotion of EnMS, the certification schemes for implementers and auditors and the financing schemes with development banks.

Energy efficiency in the brick making sector, phase II

The programme is promoted by the Chamber of Commerce of Bogota, funded by the Swiss Cooperation and executed by the Environmental Business Corporation (CAEM), a national business association. It aims to promote best practices in EE and innovative technologies in the brick making subsector. This project has positive results in its first phase, which supported 96 enterprises in the Cundinamarca department, resulting in savings of 38% of fuel used and 13,950 tCO₂; and is now in a second phase that will last from 2013 and 2016.

CAEM has been consulted to ensure that the enterprises which are considering adopting EE measures may also benefit from adopting EnMS and avoid replication in the support to industries.

Promotion of the Clean Energy Project USAID

The main programme objective is to increase the access to RE and to improve the EE practices in Colombia. The first aspect is to provide clean energy to the remote non-interconnected areas (NIAs) of Colombia, supporting the UPME and The Institute of Planning and Promotion of Energy Solutions (IPSE) for NIAs. The second aspect focuses on promoting and supporting the implementation of EE projects covering industry, transport, trade and services sectors in different phases including pre-investment, investment, follow up and evaluation. This output is done in collaboration with UPME.

So far the programme has supported the development of projects on sectors such as bricks, food (beverage and agro-processing) and buildings. The support given to the projects has been the preparation of bankable business plans and technical studies for submission to the national and international financial institutions.

The lessons learned at the PPF, particularly concerning its efforts to overcome the financial barriers, will be very helpful while completing component 4 of the proposed UPME-UNIDO project.

B.ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE

B.1 Describe how the stakeholders will be engaged in project implementation

UNIDO is entrusted by the Government of Colombia and by the GEF with the mandate to implement the project and to achieve its objectives, outcomes and outputs within its budget and time frame, as approved in this project document. UNIDO is accountable to the GEF for the funds of this project and will, in close consultation with UPME, implement the project according to the established UNIDO's rules and regulations, the applicable GEF requirements and the national laws. This means that UNIDO will maintain the oversight on the project implementation, manage the overall project budget, supervise the project execution, as well as organize planned evaluations.

The overall responsibility for the project execution will lie with UPME. The UPME Director will take the role of the project's administrator with the assistance of the Project Management Unit (PMU). With regards to inter-ministerial and national procedures, the PMU is responsible for the administrative procedures, for the legal certification of internal documents and communication produced. The PMU is responsible for coordination with the other national and international activities in this field, as described in section A.7.

It is expected that each set of activities to be implemented in the targeted country will be governed by the provisions of the Standard Basic Cooperation Agreement concluded between the Government of the Colombia and UNIDO in May 2000.

Decision-making level

Coordination among government agencies and the implementing agency will be achieved through a National Steering Committee (NSC) which will be chaired by UPME and UNIDO. The NSC will provide the necessary guidance and coordination to the project implementation, and will invite members and experts for specific meetings, as needed. The NSC decisions shall be made in line with the approved project document, GEF and UNIDO guidelines.

The proposed members of the NSC are:

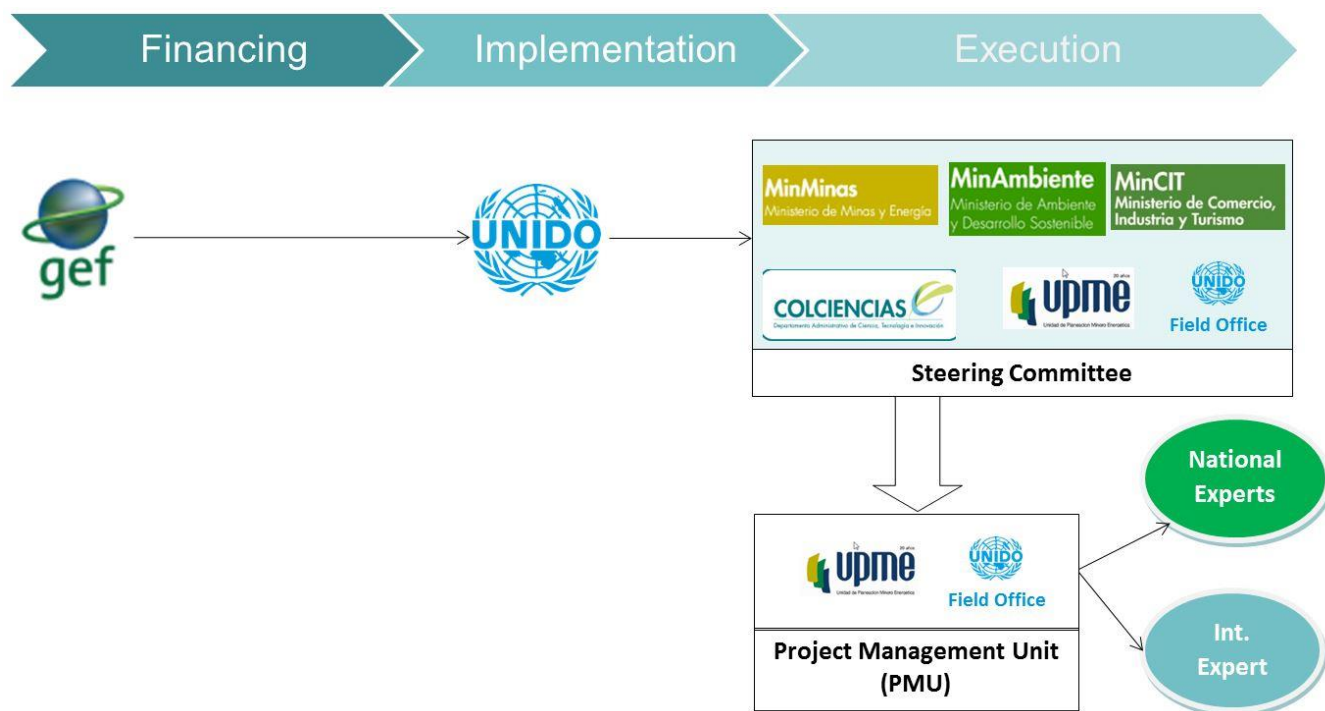
- UPME, as chair;
- UNIDO, as co-chair;
- Colciencias, as executing partner
- Ministry of Mines and Energy (MinMinas), as responsible for energy policy and design of policy instruments regarding the mining and the energy sectors;
- Ministry of Trade, Industry & Tourism (MinCIT), due to its responsibility taking care of the interests of the industrial sector and as responsible for the Colombian Low-Carbon Development Strategy (ENDBC); and
- Ministry of Environment and Sustainable Development (MinAmbiente), as Operational Focal Point of the Global Environment Facility (GEF) in Colombia.

The NSC will be in line with the approved project document and GEF guidelines and responsible for:

- dealing with the coordination of planning, implementation, monitoring and evaluation project activities
- coordinating project implementation
- acting as a discussion forum for proposed activities, policies and initiatives related to the project development or modification
- reviewing the advances and obstacles, and taking decisions on strategic and/or critical issues
- coordinating the activities of the demonstration and support programmes so that they adequately incorporate EE potential and corresponding funding
- coordinating and managing the overall project activities at a macro level
- facilitating coordination of project activities across institutions
- reviewing the project activities and their adherence to the work plan set forth in the project document, in line with the GEF regulations on major and minor amendments

- reviewing and commenting on each year's proposed work plan and budget
- The NSC will be responsible to request and review financial and progress reports
- taking decisions on the issues brought to its notice by UNIDO and other cooperating institutions, and considering any advice regarding the efficient and timely execution of the project
- initiating remedial action to remove impediments in the progress of project activities that were not envisaged earlier

The structure for project execution is described in the figure below:



NSC meetings, in line with the approved project document and the GEF and UNIDO rules and regulations, will be held once a year to approve the annual work plan and budget, and to review the project progress and the remedy actions. The chairs to the NSC and the PMU will have quarterly follow-up meetings to monitor and evaluate the progress of activities. NSC meetings will be organized by the Project Coordinator. Extraordinary meetings can be convened upon request of any member of the Committee.

Project execution

The technical working group is responsible for the management of the project activities included in the annual work plan. The working group will comprise of the UPME Director (Director of the Programme) and the PMU.

UPME and UNIDO will supervise the operation of the PMU. To do this, UPME will designate a working group called Project Technical Leader (PTL) formed by two experts from the EE group at UPME.

The PMU will be the project secretariat and will provide guidance/advice on the execution of each project component. The PMU has been established during the PPG phase and is hosted by UNIDO in Bogota.

UNIDO role in the PMU will be to appoint a Technical Coordinator of the Project and to mobilize services of its other technical, administrative and financial branches at UNIDO Headquarters and at the UNIDO Regional Office in Bogota.

The PMU will comprise of:

- National Project Coordinator (NPC)
- Junior Technical Assistant (co-financing)
- Industry national and international experts (ad-hoc as needed in work plan)

The PMU is responsible for the day-to-day management of project activities and for the coordination of stakeholders.

The NPC will be responsible for:

- coordinating the management and implementation activities of the project as set out in the project document
- coordinating the project execution with relevant stakeholders and participating organizations
- reviewing the ToRs for project team member, including consultants and contracting/subcontracting agencies
- organizing tripartite review meetings as per UNIDO procedures. Preparing Annual Project Reports (APR) and other relevant reports for submission to UNIDO and GEF Secretariat. Chair the PMU monthly meetings. Providing guidance to the NSC for execution and adhering to the planned milestones and to ensure that project activities conform to the agreed project document
- helping NSC to ensure that project activities are completed in accordance to the agreed project document
- coordinating and supervising the work carried out by project consultants/contractors (international & national). Reviewing consultant's reports, project budget revisions and all other administrative arrangements required as per national and UNIDO procedures.
- preparing the project annual work plan and budget as well as its timely submission
- submitting regular progress reports to UPME, Colciencias and UNIDO.

Technical advisors will include national and international research institutions, such as RECIEE, national research centers or universities. Each institution could have different roles based on the specific activity, however their overall roles are:

- providing technical guidance on specific relevant subject matters to the PMU
- undertaking global studies and comparing international best practice with national practices
- design of training packages for the project activities
- execution of project activities

Communication

In order to institutionally interact with the national counterparts, the UPME and the PTL will help the NPC to present the project and its progress to the CIURE. The partners of the CIURE are the main EE stakeholders in Colombia, therefore it is expected that they will provide the project with a good feedback and will help to disseminate the project outcomes.

Institutional representation: UNIDO and GEF logos must be inserted in all the relevant project publications in recognition of the inputs they made to the project. Any citation of the publications related with projects financed by GEF must acknowledge the role played by GEF.

CSOs and NGOs:

Potential CSOs and NGOs, including those focusing on gender equality issues and advocating women's empowerment, such as women's associations, will be consulted and/or involved whenever appropriate during project implementation. Regular consultations with stakeholders and local beneficiaries will ensure that the project's impact on and appropriation by the local communities can be assessed throughout project implementation.

B.2. Describe the socioeconomic benefits to be delivered by the project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund/NPIF) or adaptation benefits (LDCF/SCCF)

The project aims to improve Colombian industries energy performance, by focusing on adopting EnMS and technical measures (motor, steam and pump systems optimization). The project will produce energy savings and a positive effect on industry profitability and competitiveness, thus contributing to the national welfare.

The EE economic benefits include the improvement of industry competitiveness due to a lower energy costs and a lesser exposure to volatile energy prices, thus helping the industry to have a better control of the production costs. A direct benefit obtained from the system optimization measures is the fact that the production lines undergo a review and run more efficiently, which will be translated into productivity gains too. Finally, a benefit associated with EE is the creation of a competitiveness culture within the companies, thus enhancing and improving the efficiency of every resource usage.

The results from the UNIDO technical assistance, supporting 16 countries in the adoption of energy efficiency programs, show that the adoption of energy management systems at the enterprise level can generate savings from 10-15% in the annual energy use. Such benefits are observed across industrial scales as well as intensive and non-intensive energy sub-sectors. These direct benefits translate into greenhouse gas emission reductions as well as reduced operational costs. Indirect benefits which have been observed in the enterprises include: increased operational reliability, reduction in duration of operational processes, reduction in use of raw materials, and increased staff commitment and motivation.

In terms of environmental benefits, the annual energy savings achieved by the project are of 1.91 PJ, contributing to the GEB with direct emissions reductions of 539,000 tCO₂eq in 10 years.

The project social benefits include the building of technical capacities, which will improve the overall national skills level in energy related to theoretical and practical subjects.

Additionally, efforts in incorporating considerations of gender dimensions have been conducted, through the adoption of two main measures:

- Direct action: efforts will be taken to make the expert training programme available to female candidates holding the same qualification. A budget allocation of 5,000 \$ will be provided during the first three years to address these issues, based on the experience of previous projects. The funds can be used to address the needs of the candidates (e.g. arranging a child care room during whole-day training sessions)
- Rising stakeholders' awareness about gender issues and about its role within technical capacity development projects

A gender review has been conducted in line with UNIDO guidelines for gender mainstreaming in energy and climate change projects. The aim of the analysis was to determine the gender dimensions of the project and to incorporate sensitive additional gender indicators into the Project Results Framework (see KPIs in Annex A as well as gender assessment in Annex J).

The analysis was based on national data, which was collected to develop a set of relevant indicators for projects aiming to improve the technical capacities of women, such as the number of women graduated from science and technology programmes and number of women graduating from the CEMS diplomas courses.

The baseline was developed using the information from the National System of Information of Higher Education (SNIES). The following table shows the percentage of graduated female Science and Technology students⁶. The national average in 2012 is 37% and there are no significant differences among the four regions covered by the project.

Degree programme	gender	National	Boyacá and Cundinamarca	Caldas + Risaralda + Quindío (“Coffee corridor”)	Norte Santander	Santander
Engineering	male	11,578	705	991	383	858
Engineering	female	6,405	390	545	193	501
Sciences	male	673	11	37	12	57
Sciences	female	655	15	63	10	40
Total		19,311	1,121	1,636	598	1,456
% females		37%	36%	37%	34%	37%

Furthermore, female students graduated from the CEMS training programmes represent 21% of the total number of trained professionals. Finally, the female researchers at the RECIEE account for 25% of the total number of national Energy/EE researchers.

Based on this information, it is expected that the project activities will produce a similar impact as the one achieved in regions within the CEMS scope. Therefore, it was decided to promote the participation of women in order to reach, at least, 20% women in the training activities.

B.3. Explain how cost-effectiveness is reflected in the project design

The proposed project contributes to improving the productivity in the industries and to reducing GHG emissions in a sustainable manner in the new regions covered. Additionally, co-financing resources from the entities in the environmental, energy, and science and technology sectors create synergy in the available resources and help to coordinate development initiatives in the industrial sector.

This opens a new stage in promoting EE actions and building a management culture in the Colombian industry. New paths are created with the participation of universities, enterprises and government, characterized by innovations and technological change impact through processes optimization, best operational practices and changes in the culture of the industrial organization. The project covers new regions with energy intensive industries, all of them highly important to the productive and competitive development of the respective regions.

The strengthening of policies and institutions, market mechanisms, financing schemes and technical standards are project goals aiming to create the appropriate conditions for developing IEE projects. Similarly, the strengthening of technical capacities and the demonstration effects with concrete measures in industries participating in the project result in a positive cost-effectiveness, reducing the energy consumption and the pollutant emission the country.

These strategies ensure sustainability, technical knowledge transfer and dissemination through experts and the creation of a cadre of highly specialized energy managers which are available as a resource to industry.

⁶ The analysis covered graduated students from different programmes including Engineering (Environment, Mining, Electricity, Industrial, Mechanics, Chemistry) and Sciences (Physic, Chemistry and Mathematics).

The strengthening of capacities on energy end-use audit and system optimization, with demonstrated and measured results in industrial facilities and the system assessment by trained national experts may help to achieve energy savings and reduce additional emissions as enterprises implement the recommendations.

The project cost-effectiveness in terms of CO₂ reductions vs GEFTF investments and co-financing amounts, considering both the direct impact during the project development and the post-project period (2015-2027) is 3.52 \$/ tCO₂. This figure is reasonable, considering the industry conditions and Colombia background in EE projects, as observed in the table below:

Using a benchmark analysis, it is possible to compare the situation with Ecuador, where a similar project is being implemented. Considering the progress, impacts and outcomes of the experience in Ecuador, and the total costs of the project cost, the cost-effectiveness indicator is 4.43 \$/ tCO₂. Finally, the indicator of the UNDP-labelling project, currently in progress, is 3.8 \$/tCO₂. These figures have the same order of magnitude, and are comparable with the Colombian estimate.

Projects like the PEN-CEMS Strategic National Programme on EnMS exhibit a lower cost-effectiveness of 11.49 \$/tCO₂ compared with the impact in emissions reductions, because the main part of the resources were allocated to capacity-building in universities, and awareness and preparation measures at facility level aiming to implement management system. The project raised the awareness of 500 representatives of the strategic area of industries, trained more than 600 representatives from industrial, academic and supporting institutions in energy management as advanced experts; characterized 50 enterprises with energy intensive facilities and sustained the implementation of EnMS in 12 of those organizations in Bogota, Medellin, Cali, Barranquilla and Bucaramanga.

The Promotion of Market Opportunities for Clean Energy (OPEN) project completed training, awareness-building and route-assessment activities for 180 companies in Bogota and interacted with the financial sector and with ESCOs to develop EE projects using energy performance contracts. The results of the project were that the participation of ESCOs in the market was increased. ESCOs created a project portfolio to be financed by banks. Most of the industries reported that the implementation of the project recommendations and impacts on productivity; production costs reductions, emissions reductions, improvements in the electrical installations and better equipment maintenance.

Project name and number	Country	Agency	Technology	Application	Cumulative Emission reductions for saving achieved	GEF funding	Co-financing	Cost-effectiveness (total funding)	Cost-effectiveness (GEF funding)	Emission reduction considered
					t CO ₂	\$	\$	(US\$/tCO ₂)	(US\$/tCO ₂)	
Proposed project										
5828 - Promotion of industrial energy efficiency in Colombian industries	Colombia	UNIDO	EnMS, Motor, Steam and Compressed Air Systems Optimization	Industrial use	2,644,978	\$1,182,500	\$6,616,390	\$2.95	\$0.45	includes direct, direct post project and indirect bottom up
Benchmark projects										
3930 - Energy Efficiency Standards and Labels in Colombia (S&L Colombia)	Colombia	UNDP	energy efficiency labelling of white goods	domestic use	1,039,000	2,500,000	6,870,000	\$9.02	\$2.41	includes direct
3479 - CO-EFFICIENCY: Improving Energy Efficiency in Buildings	Colombia	UNDP	energy efficiency	buildings	186,400	975,000	4,450,000	\$29.10	\$5.23	includes direct and indirect bottom up
4147 - Industrial energy efficiency in Ecuador	Ecuador	UNIDO	EnMS, Motor, Steam Systems Optimization	industrial use	1,300,000	\$990,000	\$4,770,000	\$4.43	\$0.76	includes direct, direct post project and indirect bottom up
Comprehensive Energy Management System (CEMS)*	Colombia	Colciencias, UPME	EnMS	industrial use	215,050	\$1,972,385	\$497,733	\$11.49	government / donor funding	Direct

Project name and number	Country	Agency	Technology	Application	Cumulative Emission reductions for saving achieved	GEF funding	Co-financing	Cost-effectiveness (total funding)	Cost-effectiveness (GEF funding)	Emission reduction considered
Promotion of Market Opportunities for Clean Energy (OPEN)*	Colombia	IADB-MIF	Equipment replacement (upgrading)	industrial use	26,008	\$1,170,854	\$750,000	\$73.86	government / donor funding	Direct

(*) Programmes not funded by GEF

C. DESCRIBE THE BUDGETED M&E PLAN

Project Kick off

A Project Inception Workshop (IW) will be held within the first 2 months after the project inception, involving those with assigned roles in the project organization structure. The IW is crucial to build ownership for the project results and to plan the first year annual work plan. The IW has the following objectives:

- Assist all partners to fully understand and take ownership of the project objectives, outputs and activities. Detail the roles, support services and complementary responsibilities of local stakeholders in relation with the PMU.
- Ensure that all stakeholders are aware of the roles, functions and responsibilities within the project's decision making structures, including reporting and communication lines, and conflict resolution mechanisms. The terms of reference (ToRs) for project staff will be reviewed again as needed;
- Based on the project results framework, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification and revise assumptions and risks.
- Elaborate the M&E work plan, in accordance with the proposed budget, including a detailed overview of reporting, M&E requirements, as well as a gender analysis.
- Review financial reporting procedures and obligations, and arrangements for annual audit.
- Plan and schedule NSC meetings. Roles and responsibilities of all project organization structures should be clarified and meetings planned.

The first NSC meeting should be held within the first 12 months following the IW. An IW report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

KPIs

Monitoring and reporting procedures shall be established against/from Key Performance Indicators (KPIs) against which the project progress will be measured during quarterly, annual, mid-term and final reviews. These indicators are presented in Annex A, based on Result Based Framework approach and the reporting requirements of the GEF Climate Change Tracking tool (CC TT). The completed GEF CC TT will be submitted at the design, mid-term and final project phases.

During the inception phase, a gender analysis will be conducted. Monitoring and reporting will be done against the following sex disaggregated indicators:

- Number of stakeholders with increased awareness of energy management principles
- Number of trained local practitioners in system optimization active in the industry

Semi-annual review

A semi-annual project implementation report will be prepared for UNIDO in accordance with the Guidelines on Technical Cooperation Programmes and Projects of 2006 or as required with the updated versions.

Annual Project Review (APR)

These key reports aim to monitor progress made since the project inception and in particular what has been accomplished since the previous reporting period. The APR includes, but is not limited to, reporting on the following:

- Progress made toward project objectives and outcomes, based on the indicators, baseline data and project completion goals(cumulative)
- Project outputs delivered per project outcomes (annual)
- Lesson learned/good practice
- Expenditure reports
- Risk and adaptive management
- Portfolio level indicators (i.e. GEF tracking tools) are also used by most focal areas on an annual basis

Mid-term Review (MTR) of project cycle

The project will undergo an internal Mid-term Review (MTR) halfway through the project implementation, and taking into consideration UNIDO guidelines. . The MTR will determine progress being made toward the achievement of project objectives and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; it will highlight issues requiring decisions and actions; and will present initial lessons learned from project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term.

End of Project

An independent Final Evaluation will take place three months prior to the final NSC meeting in accordance with UNIDO and GEF guidance/guidelines. The Final Evaluation will focus on the delivery of the project results as initially planned. The final evaluation focuses on the generated outcomes in correspondence with the initially planned (as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will analyze the impact and sustainability of results/the outcomes, including the contribution to capacity development and the achievement of global environmental benefits/goals. The TORs for this evaluation will be prepared by the UNIDO Project Manager based on guidance from the UNIDO evaluation group. The final review will also include the GEF CC TT submission/use.

According to the M&E policy of the GEF and UNIDO, follow-up studies such as Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to facilitate (i) access to studies, reports and other documentation related to the project and (ii) interviews with staff involved in the project activities.

The final evaluation should also provide recommendations for follow up activities and require a management response. During the last quarter the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project results.

Learning and knowledge sharing

Project results/outcomes will be disseminated within and beyond the project intervention zone through existing information exchange networks and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy based or any other networks which may be of benefit to project implementation. The project will identify, analyze and share lessons learned that may be beneficial in the design and implementation of similar future projects.

All monitoring and evaluation documents, such as semi-annual project implementation reports, APR/PIR, mid-term and final evaluation reports, as well as learning and knowledge sharing products, will include gender dimensions wherever adequate.

Costs of M&E Activities

Type of M&E activity	Responsible Parties	Budget \$	
		GEF	Co-financing
Design of monitoring plan and tools for data collection and recording	UNIDO Project Manager (PM); Project Management Office (PMU); expert consultancy	10,000	25,000
Review of dedicated project activities on gender-specific issues	UNIDO Project Manager (PM); expert on gender issues	10,000	5,000
Periodic progress reports and monitoring of project impact indicators (as per LogFrame)	UNIDO Project Manager (PM); Project Management Unit (PMU); National Steering Committee (NSC)	10,000	30,000
Measurement GEF Tracking Tool selected indicators	UNIDO Project Manager (PM); Project Management Unit (PMU); National Steering Committee (NSC)	0	10,000
Independent terminal project evaluation	Independent evaluator for submission to UNIDO Project Manager (PM)	30,000	30,000
TOTAL indicative cost		60,000	100,000

Legal context

It is expected that each set of activities to be implemented in the targeted country will be governed by the provisions of the Standard Basic Cooperation Agreement concluded between the Government of the Colombia and UNIDO in May 2000.

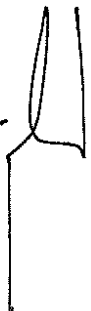

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY (IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the [Operational Focal Point endorsement letter\(s\)](#) with this template. For SGP, use this [OFP endorsement letter](#)).

NAME	POSITION	MINISTRY	DATE (MM/dd/yyyy)
Mrs. Mrs. Alejandra Torres	Chief, Office of International Affairs	Ministry of Environment and Sustainable Development	25 April 2014

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for project identification and preparation.

Agency Coordinator, Agency name	Signature	DATE (MM/dd/yyyy)	Project Contact Person	Telephone	Email Address
Mr. Philippe R. Scholtès UNIDO Managing Director Programme Development and Technical Cooperation UNIDO GEF Focal Point		06/15/2015	Ms. Bettina Schreck Industrial Energy Efficiency Unit 	+43 1 26026-3032	B.Schreck@unido.org

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

	Indicator	Baseline	Target at end of Project	Source of verification	Risk & Assumptions
Project Objective: Strengthen the technical and financial capacities of relevant stakeholders to enable the scale up of the EE measures which have been piloted by nationally driven programmes	A) Incremental direct CO ₂ eq emission reductions (tons of CO ₂ eq)	The emissions of industrial enterprises are 19,824kt CO ₂ in 2014	Cumulative Direct emission reductions of 70kt CO ₂ Cumulative post project direct emission reduction of 468 ktCO ₂	Validated energy savings from project reports	A1. Sustained and solid Government support to the project. A2. Industry drive for energy costs reduction and enhanced EE grows progressively stronger and widens. A3. Various international IEE technical cooperation programmes achieve good synergy and leverage of respective complementarities
	B) Incremental indirect CO ₂ eq emission reductions (tons of CO ₂ eq)		Indirect emission reduction of up to 2,100 ktCO ₂	Calculated emission reductions using the data from validated project reports and GEF GHG estimation tool for EE projects	
	C) Specific energy consumption of selected enterprises	The annual energy consumption of selected enterprises is of 51.92 PJ of fuel and 356.5 GWh power (see assumptions and distribution of enterprises in Annex E)	Implementation of EnMS and systems optimization and operational improvements in enterprises lead to annual fuel savings of 1.81 PJ and power savings of 26.6 GWh	Validated energy savings from project reports	
Outcome 1: The national institutions develop the mandatory regulations, voluntary standards to support and M&V schemes to support the adoption of EE in industries	1) National technical regulations on EE for boilers are adopted	The existing draft regulation contemplates cumulative measures to improve operation of boilers and promotes the rational use of energy	A technical guide for selection of appropriate boilers and their energy efficient operation is available	records of revised/new regulations	Government-level support for incentives and other supporting measures for industrial EE
	2) number of stakeholders (female and male) aware of technical regulations and their implications	Workshop on boiler regulation was held in 2014 to policymakers but industries are unaware of its implications.	Stakeholders are aware of the existing regulation and all institutions in the Quality Infrastructure are engaged to facilitate their enforcement	Records of awareness raising seminars	Availability and willingness of stakeholders to receive training

	Indicator	Baseline	Target at end of Project	Source of verification	Risk & Assumptions
	3) number of stakeholders (female and male) who get certified under the new personnel certification schemes	There are a limited number of professional training programmes provided by national universities, but no accredited certification scheme	30 professionals get national certification as implementers of EnMS (sex disaggregated)	Records form accredited certification bodies	The national quality infrastructure (normalization and accreditation bodied and eligible certification bodies) fully engage sin the accreditation scheme
Outcome 2: The development of industry specific capacities is promoted, establishing a cadre of highly specialized energy management experts from the public and private sectors; which are available as a long-term technical resource to industry and the country.	4) number of managers trained energy management	470 enterprises had their awareness raised by the SGIE project	200 enterprise managers and financial managers are trained (sex disaggregated)	Records of awareness raising seminars and training	Availability and willingness of stakeholders to receive training
	5) number of EE professionals trained at energy management implementer level	Number of graduates from diploma courses (46 females graduated from diploma course at national university, representing 21 % of graduates)	50 EE professionals received EnMS implementer level training (sex disaggregated, with at least 20% females)	Records of training programme	Availability and willingness of experts to receive training Commitment of trained experts to impart training Sufficient number of qualified females are available in the select technical area
	6) number of enterprises which develop and implement EnMS (female-led/ male led)	Development of energy management plans /energy characterization in 50 enterprises and adoption of EnMS in 12 enterprises under the SGIE projects	150 enterprises implement EnMS as a result of the practical training to EE trainees (% female/male-led enterprises)	Enterprises reports and site verifications	Willingness of enterprises involved in project to adopt EnMS
Outcome 3: Demonstrated and measured energy savings in industrial entities through application of system assessment	7) Training materials available for all systems optimization training modules	No common training programme available to all Universities under the SGIE	A consolidated training plan is rolled out in all Universities under the National Network for EE	University curricula	Localization is adequate and reflects on the usual practice in Colombian industry

	Indicator	Baseline	Target at end of Project	Source of verification	Risk & Assumptions
techniques by trained experts, leveraging additional energy savings as more industrial facilities will seek the implementation of systems optimization	8) number of (female and male) EE professionals trained at energy system optimization implementer level	General training on system is given in some of the professional training course (8 hour session per diploma course)	75 EE professionals received energy systems optimization implementer level training (25 for each type of system: motors, steam and pumps) (sex disaggregated, with at least 20% females)	Records of training programme	Availability and willingness of stakeholders to receive training
	9) number of (female and male) industry staff with awareness raised on system optimization	No specific awareness raising campaigns in place	325 industry staff with awareness raised (sex disaggregated)	Records of training programme	Availability and willingness of stakeholders to receive training
	10) number of (female and male) supply chain partners with awareness raised on system optimization	No specific awareness raising campaigns in place for vendors	75 equipment vendors with awareness raised (25 for each type of system: motors, steam and pumps) (sex disaggregated)	Records of training programme	Availability and willingness of stakeholders to receive training
	11) number of enterprises (female led /male led) which complete in depth assessment	34 feasibility studies to adopt upgrading projects were developed (technology assessments rather than system assessments) under the OPEN project	45 enterprises conduct detailed energy assessments (% female/male-led enterprises)	Enterprises reports and site verifications	Willingness of enterprises involved in project to invest in SO improvements
	12) number of enterprises that report through the newly established M&V system	There is currently no M&V system	45 selected enterprises which conduct detailed energy assessments adopt M&V system (% female/male-led enterprises)	Enterprises reports and site verifications	Willingness of enterprises to disclose information and follow through the M&V process

	Indicator	Baseline	Target at end of Project	Source of verification	Risk & Assumptions
Outcome 4: A national financing scheme for EE measures is designed and piloted	13) sectorial feasibility studies for EE investment	Sectorial assessment conducted by national banks for the building and hotels sectors	Studies for the 3 most promising industrial subsectors (winning sectors) are completed and contain social/gender dimension	Project reports	The selected subsectors are considered as promising by Financial Institutions
	14) new instruments for quick financial evaluation investment mechanisms are designed	No dedicated evaluation tools are available. Bancoldex, under the IADB project has designed a technical validation mechanism which requires detailed technical assessments	New instrument is available	Project reports	Financial Institutions are willing to adopt the instrument

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work programme inclusion and the Convention Secretariat and STAP at PIF).

GEF sec outstanding comments, following PIF review dated 10 June 2014	UNIDO Response at PIF stage	UNIDO Response at GEF CEO Endorsement stage
<p>25. Items to consider at CEO endorsement/approval.</p> <p>Estimate indirect GHG emission reductions.</p>	<p>N/A</p>	<p>The indirect top down emission reduction were estimated using macroeconomic models generated by the Ministry of Environment and the Treasury for the industry sector, resulting in 2,099,491 million tCO₂ (please refer to annex E, estimated CO₂ and energy savings, for details).</p> <p>The indirect bottom up emission reduction were estimated using the GEF GHG Manual and Tool and amount to 2,100,236 tCO₂.</p>

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS

A. DESCRIBE IF ANY FINDINGS THAT MIGHT AFFECT THE PROJECT DESIGN OR ANY CONCERNS ON PROJECT IMPLEMENTATION, IF ANY

N/A

B. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES IN THE TABLE BELOW:

PPG Grant Approved at PIF: 25,000 \$			
<i>Project Preparation Activities Implemented</i>	<i>GEF/LDCF/SCCF/NPIF Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
1. Baseline assessment	2,500	2,500	
2. Counterparts and stakeholder selection	2,500	2,500	
3. Detailed project design	5,000	4,000	1,000
4. Determination of BaU scenarios	5,000	5,000	
5. Determination of GEBs/GHG emissions	2,500	2,500	
6. Consultation and commitment confirmation	7,500	7,500	
Total	25,000	24,000	1,000

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used)

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/NPIF Trust Fund or to your Agency (and/or revolving fund that will be set up)

N/A

ANNEX E: ESTIMATED CO₂ AND ENERGY SAVINGS

Direct emission reductions

Out of the 4 project components proposed, the detailed bottom-up analysis using the GEF tool could only be conducted for two components, i.e. adoption of EnMS and efficient energy end use systems implementation and operation (systems optimization); both under the demonstration and diffusion module in the GEF guideline.

Both of the aforementioned project components also were divided into several activities for the analysis as follows:

Energy Management Systems

Adoption of EnMS in enterprises from selected high energy consuming subsectors*

Adoption of EnMS in enterprises from selected less energy consuming subsectors*

* please see following section for a detailed explanation of industrial subsectors section and analysis

Demonstration of energy efficient equipment implementation and operation:

- Steam systems optimization demonstration projects
- Pump systems optimization demonstration projects
- Motor systems optimization demonstration projects

The following method and assumptions are used in the calculation of annual energy savings for each of the aforementioned activities which are then used as an input into the respective sheet in the GEF calculation tool.

Detailed assessment of energy use by industrial subsectors and its results

As mentioned in section A.1 UPME conducted a detailed assessment of the energy use in industrial subsectors.

The assessment was divided in two studies, contracted to two independent research bodies, each of which analyzed a sample of approximately 4500 enterprises.

The division of the two studies was made using the national economic activity classification⁷, which is based in the International Standard Industrial Classification of All Economic Activities, (ISIC), which was adapted by the National Statistical Service (DANE) in 2009.

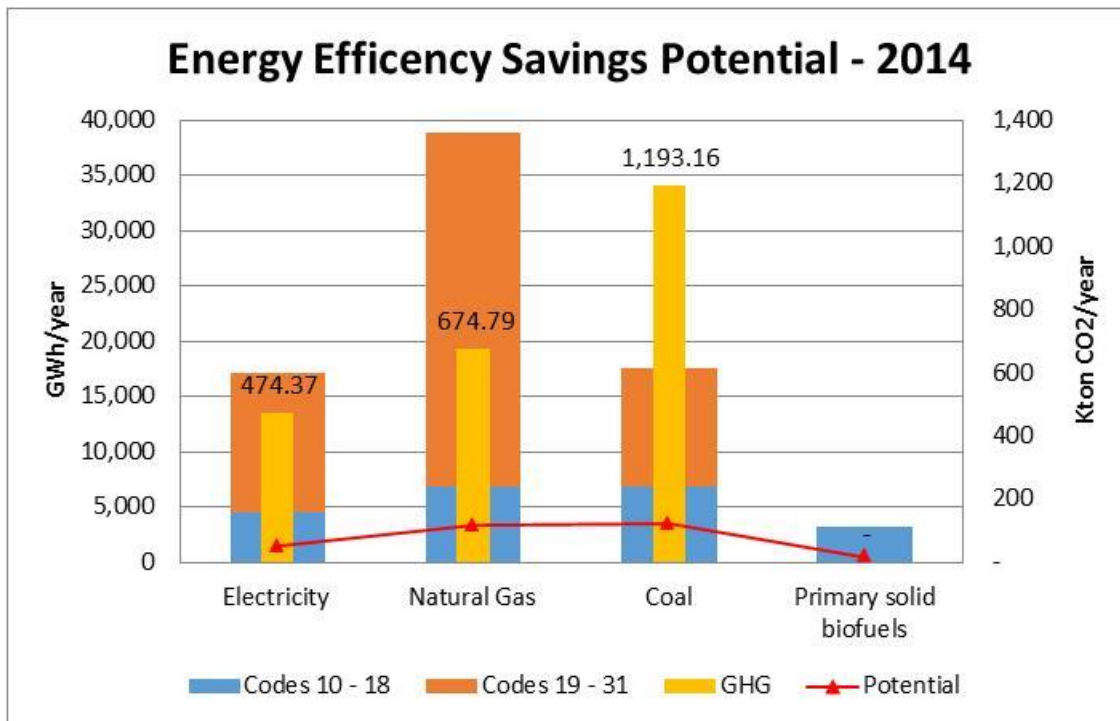
The description of this classification is as follows:

Number of subsector	Description
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textile products
14	Manufacture of wearing apparel
15	Tanning of leather; shoemaking; manufacture of luggage, suitcases, handbags and similar articles and manufacture of saddlery and harness; dressing and dyeing of fur

⁷ the classification is presented in the National Statistical Service website, denominated revision 4.c https://www.dane.gov.co/files/nomenclaturas/CIU_Rev4ac.pdf (in Spanish)

16	Transformation of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting
17	Manufacture of paper, cardboard and paper products and cardboard
18	Printing and reproduction of copies from original print
19	Coking, manufacture of oil refining and fuels blending activities
20	Manufacture of chemicals and chemical products
21	Manufacture of chemicals and chemical products
22	Manufacture of pharmaceuticals, medicinal chemicals and botanical products for pharmaceutical use
23	Manufacture of rubber and plastic
24	Manufacture of other non-metallic mineral products
25	Manufacture of basic metal products
26	Manufacture of metal products, except machinery and equipment
27	Manufacture of computers, electronics and optical products
28	Manufacture of appliances and electric equipment
29	Manufacture of machinery and equipment
30	Manufacture of motor vehicles, trailers and semi-trailers
31	Manufacture of other transport equipment
32	Other manufacturing industries
33	Installation, maintenance and repair of machinery and specialized equipment

The first study focused on a “Group 1” of industries under subsector 10-18 (less energy intensive) while the second study focused on a “Group 2” subsectors 19-33 (high energy intensive). The key finding of the sector are illustrated in the following figure, depicting the energy saving potential by energy sources, differentiated by the two grouping. The figure show higher potential in the energy intensive sectors and also presents the overall GHG savings potential; which amount to 2,342 ktCO₂/year.



The data obtained from the energy characterization reports was the main data sources for the GEF GHG tool, taking in to consideration the following assumptions.

Energy Management Systems – potential energy savings

The energy consumption of Group 1 and Group 2 subsectors, and their potential savings are calculated based on information from both the National Energy Balance and energy characterization reports published by the UPME.

The results were updated to 2015 using an annual growth rate of consumption of 3.9% for electricity and 3.6% for fuels and savings of 3.43% and 2.5% respectively (National Energy Balance).

The specific energy consumption is calculated as follows:

	Number of enterprises in sample	Electricity (GWh/ per year)	Specific Electricity (MWh/ per year and enterprise)	Fuel consumption (GJ/ per year)	Fuel consumption (GJ/ per year and enterprise)
Group 1 (ISIC 10-18 subsectors)	4,627	4,564	1,139	72,304,236	16,856
Group 2 (ISIC 19-31 subsectors)	4,630	9,051	2,426	131,437,860	28,388

The energy savings potential from the adoption of EnMS were obtained from the energy characterization reports.

For Group 1 (ISIC 10-18 subsectors), the potential savings in electricity consumption correspond to the motor driven system, which represent 80% of total consumption. The savings potential can be attributed to technological changes (8.6%), and to good management practices (5%) which represent an overall savings potential 13.6%, equivalent to 154 MWh / per year and enterprise.

Fuel savings are based on the use of fuel consumption ratios. The energy characterization reports have identified potential by fuel type and end use:

- Natural gas represents 34.3% of energy consumption, and 86% is used to generate steam. The potential savings in boilers of ISIC 10-18 subsectors has been estimated at 13-17%. Thus, the saving potential is 14.6%, equivalent to 845.27 GJ / per year and enterprise.
- Coal represents 34.5% of energy consumption, and 98% is used to generate steam. The potential savings in boilers of ISIC 10-18 subsectors has been estimated at 13-17%. Thus, the saving potential is 16.7%, equivalent to 968.63 GJ / per year and enterprise.

For Group 2 (ISIC 19-31 subsectors), the potential savings in electricity consumption correspond to the motor driven system, which represent 80% of total consumption. The savings potential can be attributed to technological changes (7.2%), and to good management practices (5%) which represent an overall savings potential 12.2%, equivalent to 295.97 MWh / per year and enterprise.

Fuel savings are based on the use of fuel consumption ratios. The energy characterization reports have identified potential by fuel type and end use:

- Natural gas represents 52.89% of total energy consumption (37,122 GJ/yr per enterprise), and 16% is used to generate steam. The potential savings in boilers for these subsectors has been estimated at 13-17%. 84% of natural gas is used in direct heat applications with energy savings potential of 16.7%. Thus, the saving potential is 16.7%, equivalent to 3,288.25 GJ / per year and enterprise.
- Coal represents 16.03% of energy consumption, and 98% is used as direct heat applications. The potential savings has been estimated at 26.6%, which is equivalent to 1,551.21 GJ / per year and enterprise.

For both groups (all subsectors), consumption of bagasse and biomass are not taken into account for the calculation of emissions savings, as their use is negligible. Fuel oil also represents a small share of energy use and has not been characterized in the assessment.

To conclude the energy savings potential from the adoption of EnMS are:

	Electricity savings potential in (MWh/ per year and enterprise)	Natural gas savings potential (GJ/ per year and enterprise)	Coal savings potential (GJ/ per year and enterprise)
Group 1 (ISIC 10-18 subsectors)	154	845	987
Group 2 (ISIC 19-31 subsectors)	296	3,288	1,551

Systems optimization – potential energy savings

The savings resulting from systems optimization of steam, motors and pumps systems are estimate as follows

For steam systems, the potential identified in the characterization are used, in the range of 13-17%. This is considered a conservative scenario, foreseeing that trainees will have many more opportunities to adopt measures in boilers in the Group 1 sectors (ISIC 10-18) which are smaller in scale and complexity.

For motor systems, the characterizations show an annual consumption of 72,000,000 kWh per year, in 191 enterprises. This is equivalent to an average annual consumption of 376,963 kWh / enterprise. The same study provides a potential saving of 10.7%, resulting that the average savings of 40,335 kWh / per year and enterprise.

For pump systems, there was no direct assessment; however, the characterization studies show that 20% of the electric motors drive a pumping application. It has been considered that in addition to the savings for the motors (10.7%) an additional 10% corresponds to improvements in the efficiency of the pumping systems. Hence, savings are estimated at 48,000 KWh per year and enterprise.

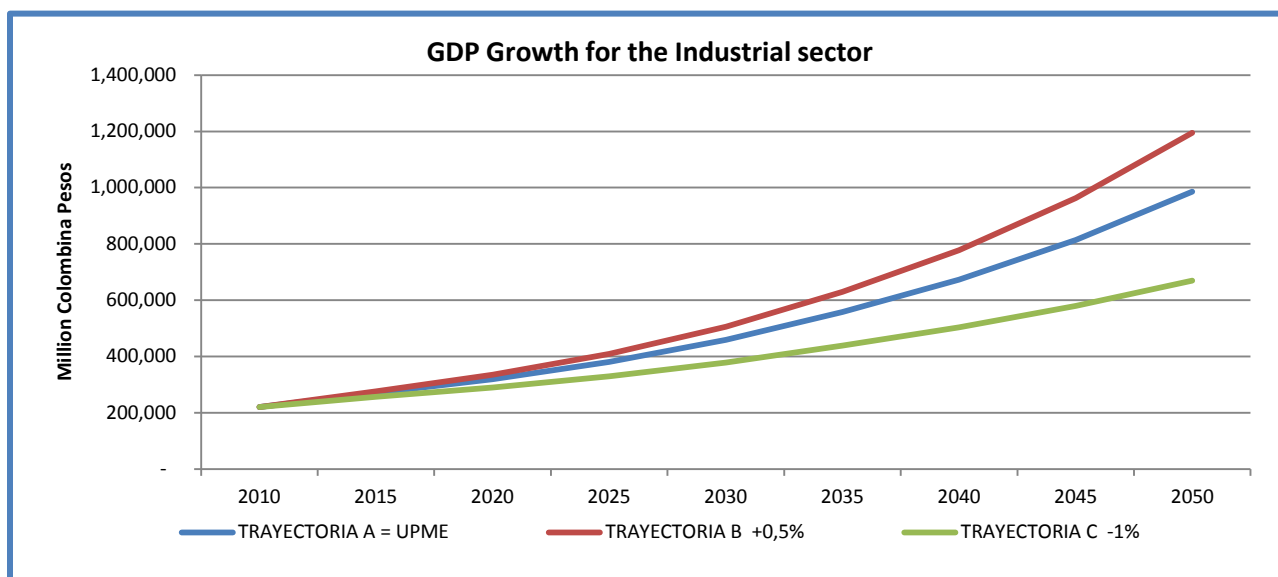
Indirect emission reductions – Top Down

The market potential of GHG mitigation for the industrial sector has been estimated by using the data and mitigation scenarios modeled with the recently released “2050 CO₂ calculator tool”⁸. The calculator was commissioned by the Ministry of Environment team responsible for the Colombian Low Carbon Development Strategy.

The CO₂ calculator tool has been developed with the capacity to model the total industry GHG emissions for three different economic growth paths, and then offset the total GHG emissions value by modeling the impact of four different national EE strategies. The strategies range from the most conservative in the abatement amount to a more ambitious yet more expensive abatement path.

The following figure depicts the potential growth paths for the Industrial Sector in Colombia

⁸ Accessible at <http://www.calculadoracolombia2050.com/>



- Blue growth path (A): is based on the energy demand scenario that UPME has planned until 2050
- Red growth path (B): it is a high demand scenario with considers an additional 0.5% growth in the annual GDP than what was estimated by UPME
- Green growth path (C): it is a low demand scenario with considers a decrease of 1% in the annual GDP, compared to the estimated by UPME

Given the recent review by the National Treasury⁹ of the national economic growth goals for 2015, which take into consideration the recent volatility in the oil prices, indicate that the growth path “C” should be considered as baseline.

With this baseline growth scenario, then, GHG savings were calculated both for the baseline scenario offset by national EE strategies 3 and 4. The strategies proposed by the calculator tool are

- Strategy 1 (minimum ambition): GHG emission reductions which can be attributed to process improvement are of 0% and EE measures are of 0%
- Strategy 2 (moderate ambition): GHG emission reductions which can be attributed to process improvement are of 5% and EE measures are of 2.5%
- Strategy 3 (highly ambitious): GHG emission reductions which can be attributed to process improvement are of 10% and EE measures are of 5%
- Strategy 4 (extremely ambitious): GHG emission reductions which can be attributed to process improvement are of 14% and EE measures are of 10%

Finally, given the level of financial investments required to implement each of the four EE strategies, especially strategy 4, the total market potential was defined as the average of the two former scenarios. That is, the average between cumulative GHG 10-yrs savings for the mitigation cases “baseline vs. EE.strategy3” and “baseline vs. EE.strategy4”. The results were as follows:

- Expected GHG savings for the first 10 years of the “baseline vs. EE.strategy3” is 4,201,522 tCO₂.
- Expected GHG savings for the first 10 years of the “baseline vs. EE.strategy4” is 6,295,933 tCO₂.

Thus, the average 10-yrs market GHG emissions reduction potential is 5,248,728 tCO₂. As recommended in the GEF manual, applying a causality factor of 40 % this amount totals 2,099,491 million tCO₂.

⁹ By Treasury, <http://www.eltiempo.com/economia/sectores/meta-de-crecimiento-para-el-2015/14940476> (in Spanish only)

ANNEX F: BUDGET ALLOCATION

Budget Allocation			
Component 1 – Standards and Technical Regulations	GEF	Co-Financing	TOTAL
International experts(s)	60,000		60,000
National Consultants	110,000	150,000	260,000
Travel			
Subcontracts			
Training, Seminars	20,000	100,000	120,000
Equipment; premises		150,000	150,000
Misc.		50,000	50,000
TOTAL	190,000	450,000	640,000
Component 2 – Scale up the programme "Comprehensive Energy Management System" (CEMS) to national level	GEF	Co-Financing	TOTAL
International experts(s)	30,000		30,000
National Consultants	35,000	100,000	135,000
Travel	35,000		35,000
Subcontracts	420,000	500,000	920,000
Training, Seminars		1,300,000	1,300,000
Equipment; premises		1,000,000	1,000,000
Misc.	25,000		25,000
TOTAL	545,000	2,900,000	3,445,000
Component 3 – Transfer of system optimization technologies	GEF	Co-Financing	TOTAL
International experts(s)	15,000		15,000
National Consultants	160,000	80,000	240,000
Travel	17,500		17,500
Subcontracts	220,000	300,000	520,000
Training, Seminars		271,978	271,978
Equipment; premises	225,000	42,818	267,818
Misc.		2,725,102*	2,725,102
TOTAL	637,500	3,419,898	4,057,398
Component 4 – Promotion of financial mechanism for investment promotion at enterprise level	GEF	Co-Financing	TOTAL
International experts(s)	60,000		60,000
National Consultants	90,000	100,000	190,000
Travel			
Subcontracts		200,000	200,000
Training, Seminars		400,000	400,000
Equipment; premises			
Misc.		10,000,000*	10,000,000
TOTAL	150,000	10,700,000	10,850,000

Budget Allocation – continued			
Component 5 – Monitoring & Evaluation (M&E)	GEF	Co-Financing	TOTAL
International experts(s)	25,000		25,000
National Consultants	5,000	45,000	50,000
Travel	30,000	5,000	35,000
Subcontracts			
Training, Seminars		25,000	25,000
Equipment; premises		25,000	25,000
Misc.			
TOTAL	60,000	100,000	160,000
Project Management	GEF	Co-Financing	TOTAL
International experts(s)			
National Consultants	95,000	150,000	245,000
Travel	10,000	15,000	25,000
Subcontracts			
Training, Seminars		75,000	75,000
Equipment; premises		40,000	40,000
Misc.	5,000	20,000	25,000
TOTAL	110,000	300,000	410,000

* the funds described under component 3 and 4 as miscellaneous are the credit lines available with national financing institutions (Bancoldex) equivalent to 12,275,102 USD, which enterprises may use to finance the adoption of EE measures

UNIDO in kind contribution

UNIDO's in-kind contribution is estimated as follows:

	Description	unit	number	cost (\$/ unit)	Total \$
License costs for UNIDO Systems Optimization training material (3 packages: steam, motors and pumps)					
1	Awareness raising	license fee	325	150	48,750
2	Vendors	license fee	75	250	18,750
3	User	license fee	150	500	75,000
4	Experts	license fee	75	1,000	75,000
5	Staff time from Compliance Infrastructure Unit (PTC/TCB/CIU) on accreditation/certification of professionals in energy management systems	weeks	11.5	3,000	34,500
6	Monitoring and evaluation	weeks	16	3,000	48,000
	Total				300,000

ANNEX G: TIMELINE OF THE ACTIVITIES

	Activities	2015		2016				2017				2018	
		III	IV	I	II	III	IV	I	II	III	IV	I	II
	Component 1 (Standards and Technical Regulations)												
1.1	Revision of the legal EE framework			■									
1.2	Dissemination of technical regulation				■	■	■						
1.3	Definition of certification schemes					■	■						
1.4	Piloting of the certification programme							■	■	■	■		
1.5	Design of a M&E scheme					■	■						
		III	IV	I	II	III	IV	I	II	III	IV	I	II
	Component 2 (Scale up the CEMS programme)												
2.1	Energy management training for 200 enterprises		■	■	■	■	■						
2.2	EnMS training for 50 enterprises			■	■	■	■	■	■	■			
2.3	Scale up of the CEMS	■	■										
2.4	Awareness raising of 500 industrial entities	■	■	■	■	■	■						
2.5	EnMS implementation for at least 150 entities					■	■	■	■	■			
		III	IV	I	II	III	IV	I	II	III	IV	I	II
	Component 3 (Transfer of system optimization technologies)												
3.1	Development of training tools	■	■										
3.2	System optimization training for 75 professionals				■	■	■	■	■	■			
3.3	Awareness training for 400 industry representatives									■	■	■	
3.4	45 in-depth energy system assessments						■	■	■	■			
3.5	Application of M&V systems							■	■	■			
		III	IV	I	II	III	IV	I	II	III	IV	I	II
	Component 4 (Financial mechanism)												
4.1	Evaluation of existing financing schemes				■	■							
4.2	Design of 2 financing schemes					■	■						
4.3	Portfolio creation								■	■			
4.4	Implementation management									■	■		
		III	IV	I	II	III	IV	I	II	III	IV	I	II
	Component 5 (Monitoring & Evaluation)												
5.1	Design and execution of the project M&E plan	■	■	■	■	■	■	■	■	■	■	■	■
5.2	Final evaluations				■		■		■				■
5.3	Follow up actions												■

ANNEX H: CO-FINANCING DETAILS

Co-financing by sources and type	As indicated in letters (in \$)			
	<i>in cash</i>	<i>comments</i>	<i>in kind</i>	<i>comments</i>
Government agencies				
UPME	4,600,000	The cofinancing includes the future fiscal benefits planned for the period 2015-2018	40,000	Are equivalent to staff costs for 3 years
Colciencias	0	The cofinancing from Colciencias is transferred in cash to the RECIEE network	17,007	Are equivalent to staff costs for 3 years
Colombian Knowledge Network on Energy Efficiency (RECIEE)	0		97,789	Staff contribution, consolidation of regional capacities
Private Sector – Chambers of Industry				
Copper Alliance Latin America	0		30,000	
Chamber of Large Energy and Gas Consumers	0		0	They are willing to contribute with their staff time, training venues and outreach to members but chose not to quantify their contribution
Financial sector				
Bancoldex	12,725,102	Bancoldex has allocated 90 billion COP for relevant credit lines, equivalent to 38,265,306 \$ per year. They have disbursed of 10 billion COP in first 6 months, hence it is considered that 30 billion COP would be available over the project duration if 3 years	0	
GEF Agency				
UNIDO	60,000		300,000	
Total	17,385,102		484,796	
Total indicated in the PIF	5,800,000		1,200,000	

It is worth noting that there have been significant variations the exchange rate in the Colombian Peso (COP) since the issuance of the letters (April to June 2014) to the submission of the GEF CEO EF (April of 2015). To calculate the cofinancing the projected future exchange rates for the period 2015-2018 (BanColombia) were used, and this average is of 2,352 COP/\$.

ADDITIONAL ANNEXES (IN A SEPARATE FILE)

ANNEX I: LETTERS OF CO-FINANCING

Please see separate file

ANNEX J: GENDER ANALYSIS

Please see separate file

ANNEX K: DETAILED POLICY FRAMEWORK

Please see separate file

ANNEX L: LIST OF ACRONYMS

Please see separate file