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执行蒙特利尔议定书
多边基金执行委员会
第七十六次会议
2016 年 5 月 9 日至 13 日，蒙特利尔

项目提案：哥伦比亚

本文件包含多边基金秘书处对下列项目提案的评论和建议：

泡沫塑料

- 示范项目是为了验证通过开发有成本效益的配方在第 5 条缔约方内使用氢氟烯烃生产不连续板材　开发计划署

哥伦比亚

项目标题 **双边/执行机构**

(a)	示范项目是为了验证通过开发有成本效益的配方在第 5 条缔约方使用氢氟烯烃生产不连续板材	开发计划署

国家协调机构	环境部，国家臭氧机构

最新报告的项目中消耗臭氧层物质的消费数据

A: 第 7 条数据（截止 2016 年 3 月的 2014 年 ODP 吨）

氟氯烃	156.03

B: 国家方案行业数据 (截止 2016 年 3 月的 2014 年 ODP 吨)

HCFC-22	67.4
HCFC-123	2.1
HCFC-141b	86.3
HCFC-142b	0.3

余下仍符合资助条件的氟氯烃消费量 (ODP 吨)	146.63

本年度业务计划分配款		资金百万美元	淘汰 ODP 吨
	(a)	n/a	n/a

项目名称:	
企业使用的消耗臭氧层物质(ODP 吨):	13.27
将被淘汰的消耗臭氧层物质(ODP 吨):	0.44
将被逐步采用的消耗臭氧层物质 (ODP 吨):	n/a
项目期限 (月):	12
申请的首付款 (美元):	459,450
最终项目费用 (美元):	
增支资本费用：	
意外开支(10 %):	
增支经营成本：	
项目监测和报告	
项目总费用：	248,380
地方所有权 (%):	100%
出口部分 (%):	0%
申请赠款 (美元):	248,380
成本效益 (美元/千克):	n/a
执行机构支助费用 (美元):	22,354
多边基金的项目总费用（美元):	270,734
对应资金状况 (Y/N):	Y
包括项目监测进度标志 (Y/N):	Y

秘书处的建议	单独审议

项目说明

背景

1. 开发计划署代表哥伦比亚政府向第七十四次会议提交了为验证通过开发有成本效益的配方在第 5 条缔约方使用氢氟烯烃生产不连续板材和喷涂泡沫塑料的示范项目申请，金额为 459,450 美元， 外加最初提交的机构支助费用 32,162 美元[1]。经讨论后，执行委员会决定参照第 74/21 号决定[2], 该示范项目可重新提交第七十五次会议（第 74/38 号决定）。

2. 回应第 74/38 号决定，开发计划署向第七十五次会议重新提交了上述示范项目的申请，费用总额为 335,280 美元，其中向多边基金申请 282,480 美元，外加 19,774 美元的机构支助费[3]。经专为审查向第七十五次会议提出的所有低全球变暖潜能值技术示范项目申请设立的联系小组讨论之后，执行委员会决定将七个示范项目，包括哥伦比亚的泡沫塑料项目，推迟至第七十六次会议审议（第 75/42 号决定）。

3. 回应第 75/42 号决定，开发计划署将提交第七十五次会议的关于上述示范项目的申请重新提交第七十六次会议。提交的项目提案载于本文件附件一。

项目目的

4. 好几个第 5 条国家在其氟氯烃淘汰管理计划第一阶段已将其规模最大的泡沫塑料企业转型为使用碳氢化合物发泡剂。在第二阶段这些国家必须解决微型、小型和中型企业生产不连续板材、喷涂泡沫塑料和整皮泡沫塑料余下的 HCFC-141b 消费问题，这些企业没有技术和财务资源安全地处理易燃发泡剂。新近开发的氢氟烯烃显示用于生产硬质聚氨酯泡沫塑料时比高全球变暖潜能值饱和氢氯碳化合物具更好的散热性能；但是由于其单位成本价格高昂，以及第 5 条国家缺乏使用经验，因而采用的不多。

5. 据此，该示范项目提议验证将降低氢氟碳化合物（即 HFO-1233ze(E) 和 HFO-1336mzzm(z)）的硬质聚氨酯配方用于生产不连续板材；最大限度平衡成本/业绩，达到类似使用 HCFC-141b 配方的散热性能；并对各氢氯碳化合物/水配方同使用 HCFC-141b 的配方进行成本对比分析。该项目的结果或许可以在哥伦比亚和其他第 5 条国家泡沫塑料生产中复制。

6. 参与企业为 Espumlatex[4], 这家配方厂有 18 个混合罐、一个经认证的质量控制实验室，实验室对硬质聚氨酯配方的基本性能（自由上升密度、反应性、泡沫塑料导热性、抗压强度、尺寸稳定性和加速老化）进行检测。

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[1] UNEP/OzL.Pro/ExCom/74/25.

[2] 执行委员会决定，除其他外，允许可向第七十五次会议提交数量有限的、为空调制造行业编制的低全球变暖潜能值技术示范项目补充资金申请，重新提交两个已全面编制的示范项目（包括哥伦比亚项目）和关于区域制冷的可行性补充研究申请。

[3] UNEP/OzL.Pro/ExCom/75/42.

[4] 在由 CFC-11 转向 氟氯烃的过渡期内， Espumlatex 执行了两个项目: "“Espumlatex Promicolda 将制造柔性模压和连皮泡沫塑料从使用 CFC 11 转换为使用水技术的追补供资” (COL/FOA/32/INV/49) 和“Espumlatex 配方厂周围的 25 个小型企业在制造各种硬质聚氨酯泡沫塑料用途中由使用 CFC-11 转换为使用 HCFC-141b 和水基技术”(COL/FOA/32/INV/48)。"在 2011-2013 年， Espumlatex 还担任了日本-哥伦比亚

项目执行

7. 将执行下列活动：

(a) 制定实验规则（运用程序和条件、性能检测和检测方法）；Espumlatex 使用高压分配器和常规模具制备泡沫塑料样品；

(b) 采购更多实验室设备以衡量泡沫塑料的脆性（至关重要，鉴于硬质聚氨酯高水分配方所达到的尿素含量）；并显示关键泡沫塑料性能（如，导热性、抗压强度和尺寸稳定性）；

(c) 在一家当地不连续板材制造厂 ABC Poliuretanos 进行了实地检测，并相应淘汰了 4 公吨(mt) (0.44 ODP 吨) 的 HCFC-141b；

(d) 两次向哥伦比亚和拉丁美洲产业宣传的研讨会。

8. 项目期限预期为 12 个月。

项目预算

9. 表 1 详列了最初提交第七十六次会议的项目成本摘要。

表 1. 按活动分列的项目成本（美元）

说明	单位成本	数量	资金	供资	成本总额
国际技术援助	30,000	1	30,000		30,000
计划	5,000	1	5,000		5,000
开发配方	110,000	1	110,000	36,000	74,000
脆碎性测定器	10,000	1	10,000		10,000
泡沫塑料检测			30,000	10,000	20,000
开发配方用材	240	20	4,800		4,800
实地检测用材	4	1,000	4,000		4,000
泡沫塑料检测/评价	5,000	1	5,000	2,000	3,000
技术传播	20,000	2	40,000		40,000
当地顾问	36,000	1	36,000		36,000
项目监测/报告	30,000	1	30,000		30,000
小计			304,800	48,000	256,800
意外开支 (10%)			30,480	4,800	25,680
成本总额			335,280	52,800	282,480

同 Achilles 公司双边项目下关于喷涂泡沫塑料超临界二氧化碳技术示范项目的当地配方厂 (COL/FOA/60/DEM/75)。

秘书处的评论和建议

评论

10. 秘书处赞赏地注意到，开发计划署编写的最初提交第七十四次会议，而后重新提交第七十五次和第七十六次会议的项目提案，未从多边基金获取编制资金。秘书处还注意到，已依照第 74/21(c)号决定[5]修订了提案，仅解决不连续板材问题，因而申请的赠款值降至 282,480 美元，而不是最初为不连续板材和喷涂泡沫塑料申请的 459,450 美元 。对应方 Espumlatex 的捐款估计为 52,800 美元。

11. 秘书处和开发计划署关于提交第七十四次、第七十五次和第七十六次会议示范项目的讨论，主要涉及与哥伦比亚提交第七十五次会议的氟氯烃淘汰管理计划第二阶段申请[6]所包含的活动可能同提议的示范项目发生重叠问题，该申请提出全部淘汰用作发泡剂的 HCFC-141b。对于这一问题，开发计划署澄清说，氟氯烃淘汰管理计划第二阶中提议的由 Espumlatex 进行的开发工作是为了满足好几个泡沫塑料用途不同（包括不连续板材）的消费方的具体要求，而提议的示范项目则满足一般类型的不连续板材要求。两项开发性质不同，但都是需要的。因为每一个配方厂家根据其客户的具体需要，都有本厂的配方，示范项目则作为对减少氢氟碳化物配方的绩效的一般性指导。这会提供实验证据作为优化起点。

12. 在关于成本合理化的再次讨论中，开发计划署同意进一步调整成本总额，结果是申请 248，380 美元，外加机构支助费用。秘书处还指出，执行委员会提供的确保提交最佳示范项目提案的指导中称，项目也应当考虑到区域和地理分布情况(UNEP/OzL.Pro/ExCom/73/62 号文件第 97(e)段)。执行委员会第七十五次会议核准了哥伦比亚 Industrias Thermotar ltda 公司使用 R290（丙烷）作为替代制冷剂制造商用空调的示范项目。

结论

13. 秘书处指出，该项目拟示范用低全球升温潜能值代用品代替好几个第 5 条国家中普遍使用的 HCFC-141b 生产不连续板材。配方厂家 Espumlatex 提供估计超过 211,000 美元的对应资金，展现了对执行该项目的坚定承诺。在当地不连续板材制造厂的实地检测将导致淘汰 0.44 ODP 吨 HCFC-141b；不过，这一消费量不得从哥伦比亚符合供资条件的氟氯烃剩余消费量中扣除，因为该国政府已承诺通过执行其氟氯烃淘汰管理计划第二阶段，全部淘汰 HCFC-141b。在第七十五次会议上，执行委员会核准哥伦比亚 Industrias Thermotar ltda 使用 HC-290 （丙烷）作为制冷剂代用品制造商用空调的示范项目。

建议

14. 执行委员会不妨考虑：

(a) 在执行委员会对以低全球升温潜能值替代品代替氟氯烃示范项目提案的讨论的背景下，按项目审查期间所查明问题概览文件(UNEP/OzL.Pro/

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[5] 通过第 74/21(c)号决定，双边和执行机构被要求将示范项目成本合理化，以便按照第 72/40 号决定规定的 1000 万美元可用资金，核准更多示范项目，并进一步探索其他的补充资金来源。

[6] UNEP/OzL.Pro/ExCom/75/42.

ExCom/76/12)所述，审议验证在哥伦比亚通过发展具有成本效益的配方在第5条国家内将氢氟烯烃用于生产不连续板材的示范项目；

(b) 是否按照第 72/40 号决定核准验证在哥伦比亚通过发展具有成本效益的配方在第 5 条国家内将氢氟烯烃用于生产不连续板材的示范项目。

Annex I

PROJECT COVER SHEET

COUNTRY: Colombia **IMPLEMENTING AGENCY:** UNDP

PROJECT TITLE: Demonstration project to validate the use of Hydrofluoro Olefins (HFO) for discontinuous panels in Article 5 parties through the development of cost effective formulations

PROJECT IN CURRENT BUSINESS PLAN	
SECTOR	Foam
SUB-SECTOR	Rigid PU (discontinuous panels)
ODS USE IN SECTOR (2014)	668 metric tons (HCFC-141b)
ODS USE AT ENTERPRISE (2014)	120.6 MT of HCFC-141b
PROJECT DURATION	12 months
TOTAL PROJECT COST:	
Incremental Capital Cost	US $ 304,800
Contingency	US $ 30,480
Total Project Cost	US $ 335,280
LOCAL OWNERSHIP	100%
EXPORT COMPONENT	0 % to non-A5
REQUESTED GRANT	US $ 282,480
COST-EFFECTIVENESS	Non applicable
IMPLEMENTING AGENCY SUPPORT COST	US $ 19,774
TOTAL COST OF PROJECT TO MULTILATERAL FUND	US $ 302,254
STATUS OF COUNTERPARTS FUNDING	Received letter of commitment
	Included
NATIONAL COORDINATING AGENCY	Ministry of Environment - National Ozone Unit

Project summary

This project undertakes the validation of the Hydrofluoro Olefins (HFOs), a low GWP and non-flammable option, for discontinuous panels in the scenario of the Article 5 parties through the development of polyurethane (PU) foam formulations with reduced HFO contents that have CO_2, derived from the water-isocyanate reaction, as co-blowing agent. The aim is to optimise the cost/performance balance while achieving a similar foam thermal performance to that of HCFC-141b based formulations.

Impact of project on Country's Montreal Protocol Obligations

The project aims to contribute to the country obligation to reduce the HCFC consumption as per the Montreal Protocol obligation by converting the current HCFC-141b foam blowing technology to the HFO based formulations. The Colombian discontinuous panels subsector used 98.5 tonnes of HCFC-141b in 2014. With the results of this project, a significant portion of this HCFC-141b consumption would be replaced by this technology during the second stage of the HPMP. A direct impact of this project is the conversion of ABC Poliuretanos, 5.2 tonnes of HCFC-141b, in the mentioned second stage.
The results of this project would be applicable not only for the discontinuous panels subsector but the principles would also apply to other foam applications in Colombia and other developing countries.

Prepared by: Mr Miguel W. Quintero Date: September 11, 2015

1. BACKGROUND

1.1. PROJECT BACKGROUND

This project has been prepared as response to the Executive Committee Decision 72/40. It is part of a set of projects with the objective to validate chemical systems for use with non-HCFC blowing agents in the context of Decision XIX/6.
The developing countries will address in the short term the second phase of the HPMP (2015-2020) in the foam sector. One of the most critical subsectors that still uses HCFC-141b and accounts for a significant market portion is the manufacture of **discontinuous panels** for the construction and the commercial and industrial refrigeration industries. It is characterized by a great number of small and medium enterprises without the sufficient knowledge and discipline to handle flammable substances. This factor along with the lack of economies of scale prevents the adoption of hydrocarbons and the introduction of high GWP alternatives such as HFCs would result in a negative climate impact.
This projects undertakes the validation of the Hydrofluoro Olefins (HFOs), a low GWP and non-flammable option, for discontinuous panels in the scenario of the Article 5 parties through the development of polyurethane (PU) formulations with reduced HFO contents that have CO_2, derived from the water-isocyanate reaction, as co-blowing agent. The aim is to optimise the cost/performance balance while achieving a similar foam thermal performance to HCFC-141b based formulations.
Further, the project aims to contribute to the country obligation to reduce the HCFC consumption as per the Montreal Protocol obligation by converting the current HCFC-141b foam blowing technology to the HFO based formulations. The Colombian discontinuous panels subsector used in 2014 98.5 tonnes of HCFC-141b. With the results of this project, a significant portion of this HCFC-141b consumption would be replaced by this technology during the second stage of the HPMP.

It is important to note that the results of this project would be applicable not only for the discontinuous panels subsector but the principles would also apply to other foam applications in Colombia and other developing countries. Therefore, the results should be seen in a broader perspective.

1.2. SECTOR BACKGROUND IN COLOMBIA

Colombia became a party to the Vienna Convention and Montreal Protocol on October 16, 1990 and on March 6, 1994 respectively. Colombia also ratified the London, Copenhagen, Montreal and Beijing Amendments. The country is fully committed to the phase-out of HCFCs and willing to take the lead in assessing new HCFC phase-out technologies, particularly in the foam sector.

The Colombian PU market can be spread out in three different industrial sectors: flexible foam (flex-slab and moulded and integral skin), rigid foam and microcellular elastomers (shoe soles). HCFCs are used in rigid foam for thermal insulation and, in marginal quantities, in integral skin.

In PU rigid foam three different segments can be differentiated: domestic refrigeration (refrigerators and freezers), commercial refrigeration (mainly bottle and commercial displays) and industrial thermal insulation for the refrigeration and construction sectors (continuous and discontinuous panels, transportation and spray). While the domestic refrigeration and most of the commercial refrigeration have been converted to hydrocarbons the remaining market players still use HCFC-141b. The main suppliers are local “system houses” (Espumlatex, GMP, Olaflex,

Química Industrial y Comercial) that sell two-component systems: a fully formulated polyol, which includes the blowing agent (HCFC-141b), and an isocyanate (Polymeric MDI).
A recent market survey showed that in 2014 out of a total of 784.25 tonnes of imported HCFC-141b, 668 were used in foam manufacture. Table 1 shows the distribution by application. Discontinuous panels account for 15% of the total HCFC-141b consumption.

TABLE 1. 2014 USE OF HCFC-141b IN THE COLOMBIAN FOAM MARKET		
Foam Application	HCFC-141b, kg	%
Commercial Refrigeration	66,390	9.94%
Continuous Panels	80,920	12.12%
Industrial Refrigeration & Construction (Discontinuous Panels)	98,589	14.76%
Spray	51,958	7.78%
Integral Skin	3,428	0.51%
Polyol formulation	366,495	54.89%
TOTAL	667,780	100.0%

Source: Imports Declarations, Database of the Ministry of Commerce, Industry and Tourism. Personal interviews with key market players (system houses and end users)

2. PROJECT DESCRIPTION

2.1. PROJECT OBJECTIVES

The objectives of this project are:

1. To validate the use as foam blowing agents of the recently developed HFOs in blends with CO_2 for the production of discontinuous panels in the context of an Article 5 party. The aim is to optimise the HFO/CO_2 ratio in the cell gas to get a similar thermal performance to HCFC-141b at a minimum incremental operating cost. The results of this project would be applicable not only for the discontinuous panels subsector but the principles would also apply to other foam applications in Colombia and other developing countries.
2. To make a cost analysis of the different HFO/CO_2 formulations versus the currently used HCFC-141b based system.

2.2. JUSTIFICATION

The Article 5 parties are in the process of preparing the second stage of the HPMPs to be implemented in the 2016-2020 period. Taking into account the priorities defined in Decision XIX/6, particularly those referred to ODP and climate change impact, the developing countries opted for converting in the first phase (2011-2015) the largest foam enterprises typically found in the domestic refrigeration and continuous panels sectors. Hydrocarbons, basically pentanes, were the substances of choice based on their favourable cost/performance balance at large size operations.
Situation is different at the second stage where the countries have to address the remaining foam sectors still using HCFCs. These sectors (discontinuous panels, spray, integral skin) are characterised by a multitude of micro, small and medium size enterprises that do not have the

adequate knowledge and operating discipline to handle flammable substances in a safe manner. This factor along with the lack of economies of scale prevents the adoption of flammable blowing agents, while the introduction of high GWP alternatives such as HFCs results in high climate impact within processes which are typically less well engineered.
The recent developed unsaturated HFCs and HCFCs (commonly called HFOs), 1233zd(E) and 1336maam(z), marketed under the trademarks Forane (Arkema), Formacel (DuPont) and Solstice (Honeywell), have shown in rigid PU foam applications such as domestic refrigeration and spray a better thermal performance that the high GWP-saturated HFCs currently used in the developed countries. Their general properties are shown in table 2. They offer a unique opportunity for introducing safe non-flammable technologies that while enhancing energy efficiency will have a positive effect on climate change in terms of greenhouse emissions. Based on the physical properties of these substances (non flammability and relatively high boiling points) it is anticipated that their application does not require the retrofit of the foaming equipment currently in use. This is particularly true and important at the level of small and medium enterprises. Commercial availability has already been established for HFO-1233zd(E). Pilot scale production of HFO-1336mzzm(Z) commenced in late 2014, with full commercialisation expected in 2016. Although for these options availability is likely to be targeted mostly in markets within non-Article 5 Parties where the requirement for improved thermal efficiency is best identified, the demand to leapfrog high GWP alternatives to HCFCs could accelerate distribution to Article 5 regions. There are not legal or commercial barriers for the introduction of these products.

TABLE 2. HFO PROPERTIES			
	Formacel® 1100	***Solstice® Liquid BA***	***Forane® 1233zd***
Common name	1336mzz(Z)	1233zd(E)	1233zd(E)
Chemical Formula	Cis-CF_3-CH=CH-CF_3	Trans-ClCH=CH-CF_3	Trans-ClCH=CH-CF_3
Molecular weight	164	130.5	130.5
Boiling Point (°C)	33	19	19
GWP (100 years	2	1	<7

From the three market sectors mentioned above, the discontinuous panels application was chosen for the development of this project taking into consideration the high volume involved. According to the last FTOC assessment report (2010), in 2008 around 7,300 tonnes of CFCs and HCFCs were used in the discontinuous panels subsector in the developing countries.

Two are the main barriers for the introduction of these substances:
1. Their high unitary cost that is reflected in the final cost of the PU formulation.
2. The minimum experience with these products in developing country conditions. This technology has not been demonstrated in conditions prevailing in Article 5 parties.

The main objective of this project is precisely to remove or attenuate the mentioned obstacles. The formulation science associated to the PU technology and the excellent foam thermal characteristics provided by HFOs open the door for the development of PU formulations with reduced HFO contents that have CO_2, derived from the water-isocyanate reaction, as co-blowing agent. The aim is to optimise the cost/performance balance of these substances, achieving a similar foam thermal behaviour to HCFC-141b at the lowest possible cost, and, simultaneously, to carry out a comprehensive assessment of the HFO performance at developing countries conditions. The project will be conducted at Espumlatex, a recognised local system house equipped with the required injection and testing laboratory facilities, and a field test with selected formulations will be done at ABC Poliuretanos, a typical small manufacturer of discontinuous panels.

2.3. METHODOLOGY

With the aim of analysing the two HFO molecules, 1233zd(E) from Honeywell or Arkema and 1336maam(z) from Chemours, in comparison with HCFC-141b, six steps are contemplated for the project development:

1. PLANNING. A statistical experimental design (DOE) will be designed having as factors (or independent variables) the type of molecule and the composition of the cell gas (mole fraction of the physical blowing agent). The responses (or dependent variables) will be the foam properties critical for this application (Lambda value, compression strength, dimensional stability, friability). A commercial HCFC-141b based formulation will be used as control.
2. FORMULATION DEVELOPMENT. The resulting formulations will be prepared at laboratory scale and injected with a conventional high-pressure dispenser. Catalysis and overall blowing agent amounts will be adjusted to have among formulations a similar reactivity and free-rise density. A typical Brett or Lance mould with temperature control will be used to manufacture the panels to test the foam properties. Samples for testing will be done by duplicate.
3. TESTING. The critical immediate and aged foam properties for this application (Lambda value, compression strength, dimensional stability, friability) will be tested following ASTM or ISO standard procedures.
4. ANALYSIS OF RESULTS: foam performance and formulation cost. A detailed analysis of the resulting foam properties at different HFO levels and the associated formulation cost will be carried out. A typical HCFC-141b formulation will be used as standard.
5. FIELD TEST. A field test with selected formulations will be done at ABC Poliuretanos, a small manufacturer of discontinuous panels with typical market characteristics.
6. TECHNOLOGY REPLICATION/DISSEMINATION OF RESULTS. One of the critical outcomes of a demonstration project is the definition of the possibility to replicate the technology in other enterprises, in other regions and in other applications. In the case of HFOs, having in mind that the main barrier for their introduction is the associated formulation cost, it is anticipated that if results are positive and an adequate cost/performance balance is achieved, there is a great potential for the technology to be replicated in other system houses in the country, in Latin America and other regions, and even in other applications such as commercial refrigeration and spray. To assure this, it is planned to conduct two workshops, a first one at local level with the participation of the other Colombian system houses (GMP, Olaflex, Química Industrial y Comercial) and interested end users, and a second one at regional level, where regional system houses, importers and end users will be invited. It is important to note that all the Colombian and several Latin American system houses have shown interest in these products. In addition to the seminars, a detailed technical report will be written with the results of the project. Information on the performance of the HFOs at different mole fractions in the cell gas along with the associated formulation cost (incremental operation cost compared to HCFC-141b) will be delivered. It will serve as starting point for the other system houses to design/develop appropriate HFO based formulations.

2.4. INFORMATION ON PARTICIPATING COMPANIES

Espumlatex

Espumlatex was established in 1959 to serve the automotive industry in Colombia as the main supplier of PU based materials: RIM and sound insulation parts and flex moulded foam for car seats. Throughout all these years it became the leader of PU suppliers in the Andean countries with annual sales of 52 million dollars in 2008. It is certified QS9000/ISO9000, EAQF level Q1 status, ISO14000.

At the end of the eighties Espumlatex expanded its activities to formulate PU systems for the manufacture of thermal insulating and integral skin foams. Its current capacity is estimated in 500 MT per month with an annual current production of 4,000 MT of PU systems, from which 2,000 MT are dedicated to rigid foam materials. 15 % of their PU systems production is exported to Ecuador, Peru and Venezuela. Additional to PU systems they manufacture PU rigid foam sheets for insulation purpose in a process that involves the production of large foam blocks and their subsequent cutting.

The system house production facilities are equipped with 18 blending tanks with capacities that go from 1,500 to 3,000 l. They have mechanical agitation, recirculation and a direct feeding system from the raw materials drums as well as a closed pumping system for raw materials loading. The basic properties of the PU systems (free rise density, reactivity, foam thermal conductivity, compression strength, dimensional stability and accelerated aging) are tested in a certified quality control laboratory.

The consumption of chemicals for the PU systems sold for the manufacture of discontinuous panels during the last 5 years was:

Table 3. Consumption of PU chemicals for Discontinuous Panels at Espumlatex, tonnes

Substance	**2009**	**2010**	**2011**	**2012**	**2013**
Polyol	327	381	425	423	462
HCFC-141b	82	96	107	106	115
Polymeric MDI	445	518	578	575	628
TOTAL	854	995	1,110	1,104	1,205

During the transition from CFC-11 to HCFCs the following two projects were carried out with Espumlatex:

- The project COL/FOA/32/INV/49, “Retroactive funding for the conversion from CFC-11 to water-based technology in the manufacture of flexible molded and integral skin foam at Espumlatex-Promicolda”, retroactively funded one of the Espumlatex´ divisions, Promicolda, for the conversion from CFC-11 to water and HCFC-141b based technologies in the manufacture of flexible molded and integral skin foam respectively. Promicolda is the Expumlatex´ division that manufactures the car seats and several parts based on integral skin foam for the automotive industry in the Andean Countries. The grant received by Promicolda was US$ 82,020.00.
- The project COL/FOA/32/INV/48, “Conversion from CFC-11 to HCFC-141b and water based technology in the manufacture of various polyurethane foam applications at 25 small enterprises centred around their systems house Espumlatex”, was an umbrella project where 25 SMEs -centred around Espumlatex as the system house- were successfully converted from CFC-11 to HCFC-141b and water based technologies. Total cost of the project was US$ 332,768.00. Espumlatex received funds for the project administrative expenses and a laboratory equipment (one K factor indicator not suitable to measure lambda values at different temperatures).

Espumlatex also served in 2011-2013 as the local system house host for the demonstration project on Supercritical CO_2 technology for spray foam undertaken under a Japan-Colombia bilateral with Achilles Corp.

The company is fully committed to test new HCFC alternatives of low GWP and has the required capability (laboratory facilities, technical knowledge and human resource). Its contribution to the project has been quantified in US$ 52,800 (see table 5).

3. PROJECT IMPLEMENTATION MODALITY

Project will be implemented by UNDP as an executing agency. Relevant activity such as equipment procurement, recruitment of experts, foam testing will be arranged under the UNDP Financial Rule and Regulation.

The following activities will be executed:

- Work arrangement with local System House to be signed between UNDP and the beneficiary as well as the National Ozone Unit (NOU).
- Development of the experimental protocol which includes application procedure and conditions, properties to test, testing methods etc.
- Formulation development and foam sample preparation to be done at Espumlatex laboratory facilities using a high-pressure dispenser and a conventional Brett mould. Procurement of a laboratory equipment to measure foam friability. This foam property is considered critical having in mind the high urea content typical of PU high water formulations.
- Testing of foam critical immediate and aged properties such as thermal conductivity, compression strength, dimensional stability and friability.
- Conduction of a field test at ABC Poliuretanos, a local discontinuous panels manufacturer.
- Delivery of two dissemination workshops to the Colombian and Latin American industry.

<u>Project implementation time schedule</u>

Table 4. Project Implementation Time Schedule

ACTIVITY	2015	2016			
	Q4	Q1	Q2	Q3	Q4
Approval	*				
Grant transfer to UNDP		*			
Work Arrangement between UNDP and beneficiary		*			
Detailed project planning. Development of experimental protocol		*			
Import of HFO samples		*			
Procurement & delivery of equipment to measure friability		*	*		
Formulation Development		*	*	*	
Foam testing		*	*	*	
Analysis of results: performance versus cost				*	
Field testing at a local discontinuous panels manufacturer					*
Dissemination workshops					*
Reporting & Final review					*

4. PROJECT BUDGET

The summary of the project cost is as follows:

Table 5. Project cost by activity

Activity	Specification or detail	Unit cost, US$	Quantity	Total Cost US$	Espumlatex contribution US$	MLF US$
International technical assistance		30,000	1	30,000		30,000
Planning	Participation of Espumlatex, National Ozone Unit (NOU) and international consultant	5,000	1	5,000		5,000
Formulation Development	Estimated that one man year effort of a qualified engineer and lab technician are required	110,000	1	110,000	36,000	74,000
Acquisition of Friability tester		10,000	1	10,000		10,000
Foam Testing	It is anticipated that around 120 foam samples (5x3x4x2) x2 will be tested for lambda, value, compression strength, dimensional stability and friability			30,000	10,000	20,000
PU material for formulation development	Estimated that 60 kg of PU system (US$ 4/kg) are required for each trial	240	20	4,800		4,800
PU material for field testing	Estimated that 1000 kg (4 drums) are required	4	1,000	4,000		4,000
Foam testing - Field evaluation	Resulting foam will be tested for lambda, value, compression strength, dimensional stability and friability	5,000	1	5,000	2,000	3,000
Technology Dissemination Workshops	For Colombian industry and Latin American countries		2	40,000		40,000
Local Consultant	Technical support to project implementation.	36,000	1	36,000		36,000
Project monitoring & reporting		30,000	1	30,000		30,000
Sub-total Incremental Capital Cost				304,800	48,000	256,800
Contingencies (10%)				30,480	4,800	25,680
Total Cost				335,280	52,800	282,480

Notes:

Formulation Development: The formulations will be prepared at Espumlatex laboratory facilities by company personnel.

Provision of equipment: The project plans to acquire a laboratory equipment to measure foam friability according to ASTM test.

Foam testing: All the foam properties will be determined at Espumlatex laboratory facilities by company technicians.

Dissemination workshop: Cost to organize the dissemination workshops is included. Two workshops will be organized, both in Colombia, a first one for the local industry and a second one for Latin America.